PROJECT MANUAL

FOR

VISUAL & PERFORMING ARTS REPLACEMENT

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COMPTON, CA 90221-5393

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COMPTON COMMUNITY COLLEGE DISTRICT

DSA SUBMITTAL

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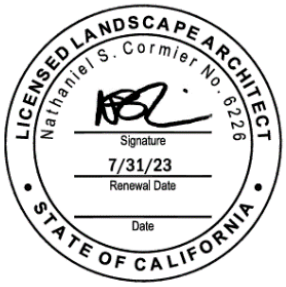

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DIVISION 03
CONCRETE

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete as indicated.
2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 20 00: Concrete Reinforcing.
3. Section 03 30 00: Cast-In-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 318 – Building Code Requirements for Structural Concrete, Chapter 26, Formwork, Embedded Pipes, and Construction Joints.
2. ACI 347 – Guide to Formwork for Concrete.

B. American Plywood Association (APA):

1. Form No. V345 - Concrete Forming Design/Construction Guide.

C. National Institute of Standards and Technology (NIST):

1. NIST Voluntary Product Standard PS 1.

1.3 SUBMITTALS

A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or where provision for vehicular traffic through falsework or shoring occurs. For all other falsework and shoring submit layout signed by California registered Civil Engineer, manufacturer’s authorized representative or a licensed contractor experienced in the usage and erection of falsework and vertical shoring. A copy of the plans and calculation shall be available at the jobsite at all times.

B. Shop Drawings: Submit Shop Drawings indicating locations of forms, construction and expansion joints, embedded items, and accessories.

C. Product Data: Submit manufacturer's Product Data for form materials and accessories.

1.4 REGULATORY REQUIREMENTS

A. California Building Code (CBC), Chapter 19A.

B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage shall prevent damage and permit access to materials for inspection and identification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.

B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.

C. Plywood: NIST Voluntary Product Standard PS 1, Group 1, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.

D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Nox-crete", or equal.

E. Tube Forms: Sonoco "Seamless Sonotubes," Ceme-Tube, Quik-Tube, or equal, of the type leaving no marks in concrete, one-piece lengths for required heights.

F. Joist Forms: Code recognized steel or molded plastic types as required.

G. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.

H. For Exposed Concrete Finish:

1. Plywood: New, waterproof, synthetic resin bonded, exterior type Douglas fir or Southern pine plywood manufactured especially for concrete formwork and conforming to NIST Voluntary Product Standard PS 1, Grade B-B grade, Class I.

2. Glass-Fiber-Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.

3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete, without deflection detrimental to tolerances and appearances of finished concrete surfaces.

4. Plywood: "Finland Form,," "Combi Form" by North American Plywood Corporation, “Plyform” by Roy O. Martin, “ProForm” by Pacific Wood Laminates, or equal. The material shall be furnished with hard smooth birch face veneers with phenolic resin thermally fused onto panel sides. Edges shall be factory sealed.

I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1 1/2-inch of concrete surface.

J. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Edoco/Dayton Superior, "Cast-Off" by Sonneborn/BASF Building Systems or equal. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.

K. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, Greenstreak, or equal.

L. Void Forms: Manufactured by SureVoid Products, Inc., Sonotube, Void Form International, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior, and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged.

B. Use form coating at all surfaces in contact with concrete.

3.2 TOLERANCES

A. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 feet length with a straightedge shall per ACI 347, Table 3.1:

Class of Surface			
A	B	C	D
1/8 inch	1/4 inch	1/2 inch	1 inch

1. Class A: Use for concrete surfaces prominently exposed to public view.
2. Class B: Use for coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.
3. Class C: Use as a general standard for permanently exposed surfaces where other finishes are not specified.
4. Class D: Use for surfaces where roughness is not objectionable and will be permanently concealed.

3.3 ERECTION

A. Plywood shall be installed with horizontal joints level, vertical joints plumb and with joints tight. Back joints by studs or solid blocking, and fill where necessary for smoothness. Reused plywood shall be thoroughly cleaned, damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.

B. Openings for Cleaning: Provide temporary openings at points in formwork to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned and inspected.

C. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.

D. Reglets and Rebates: As specified in Section 03 30 00: Cast-In-Place Concrete.

3.4 REMOVAL OF FORMS

A. Forms shall not be removed until concrete has sufficiently hydrated to maintain its integrity and not be damaged by form removal operations. Unless noted otherwise and/or permitted by the Architect, columns and wall forms shall not be removed in less than five days, floor slabs in less than seven days, beams and girders in less than 15 days, pan forms for joists may be removed after three days, but joist centering shall not be removed until after 15 days, and ramp, landing, steps and floor slabs shall not be removed in less than seven days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.

B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Section 03 3000: Cast-In-Place Concrete.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.6 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete steel reinforcement.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 10 00: Concrete Forming.
3. Section 03 30 00: Cast-In-Place Concrete.
4. Section 04 22 00: Concrete Unit Masonry.

1.2 REGULATORY REQUIREMENTS

A. Fabrication and placement of reinforcing shall be in accordance with requirements of CBC, Chapter 19A.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
6. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
7. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

B. American Concrete Institute (ACI) Publication:

1. ACI SP-66 – ACI Detailing Manual.
2. ACI 318 – Building Code Requirements for Structural Concrete, as modified by CBC.

C. American Welding Society (AWS):

1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

1.4 SUBMITTALS

A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.

B. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.5 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
2. American Welding Society (AWS).
3. American Concrete Institute (ACI).
4. CBC, Chapter 19A, Concrete.

B. Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the OWNER shall select test Samples of bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:

1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.
2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

C. Certification of Welders: Shop and Project site welding shall be performed by welding operators certified by AWS.

1.6 DELIVERY, STORAGE AND HANDLING

A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.

B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.2 MATERIALS

A. Steel Reinforcing Bars: ASTM A615, or ASTM A706 deformed grade 60 billet steel unless otherwise specified or indicated.

B. Bars or Rod Mats: ASTM A184.

C. Welded Wire Fabric for Reinforcement: ASTM A185.

D. Tie Wire: ASTM A82, fully annealed, copper-bearing steel wire, 16 gage minimum.

E. Chairs, Spacers, Supports, and Other Accessories: Standard manufacture conforming to ACI 315 fabricated from steel wire of required types and sizes. For reinforcement supported from grade, provide properly sized dense precast blocks of concrete.

2.3 FABRICATION OF REINFORCING BARS

A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.

C. Welding: Provide only ASTM A706 steel where welding is indicated. Perform welding by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings.

B. Before installation and just prior to placing concrete, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

C. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.

D. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.

E. Install and secure reinforcement to maintain required clearance between parallel bars and between bars and forms. Lapped splices shall be installed wherever possible in a manner to provide required clearance between sets of bars. Stagger lapped splices. Dowels and bars extending through construction joints shall be secured in position against displacement before concrete is installed and subsequently cleaned of concrete encrustations while they are still soft.

F. Do not install reinforcing in supported slabs and beams until walls and columns have been installed to underside of slabs and beams or until construction joints have been thoroughly cleaned. Reinforcing shall be inspected before placement of concrete and cleaned as required.

G. Use deformed bars unless otherwise indicated, except for spiral reinforcement.

3.2 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place normal weight, placement and finishing.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 10 00: Concrete Forming and Accessories.
3. Section 03 20 00: Concrete Reinforcing.
4. Section 07 26 00: Vapor Barriers.
5. Section 32 13 13: Site Concrete Work.

1.2 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 – Specifications for Structural Concrete.
3. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
4. ACI 305R - Specification for Hot Weather Concreting.
5. ACI 306.1 – Standard Specification for Cold Weather Concreting.
6. ACI 308R – Guide to External Curing of Concrete.
7. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1905A.

B. American Society for Testing and Materials (ASTM) Standards:

1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid membrane-Forming Curing Compounds for Concrete.
10. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
15. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
21. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
23. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
24. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
25. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
26. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
27. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
28. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
29. ASTM E1155 - Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
30. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
31. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
32. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
33. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

34. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.

35. ASTM F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use under Resilient Floor Coverings.

1.3 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.

1. Submit name, address and telephone number of the concrete production facility which the contractor intends to engage to design the concrete mixes. Submit name and qualifications of the proposed concrete technologist.

2. Mix Design: Submit a concrete mix design for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength, maximum slump and air content percentage. Clearly indicate locations where each mix design will be used.

a. Water/cement ration for concrete slabs on grade shall be 0.45 maximum.

3. Test Reports: Submit copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates and admixtures. Provide gradation analysis.

C. Material Samples: Submit Samples illustrating concrete finishes and hardeners, minimum 12-inch by 12-inch.

D. Certificates: Submit certification that each of the following conforms to the standards indicated:

1. Portland cement: ASTM C150.

2. Normal weight concrete aggregates: ASTM C33.

3. Lightweight concrete aggregates: ASTM C330.

4. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested by one of the methods in ASTM C33 Appendix XI, Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official, in accordance to CBC Section 1903A.5.

5. Curing materials: ASTM C171.

E. Admixtures: Submit product data for proposed concrete admixtures.

1.4 QUALITY ASSURANCE

A. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.

B. Inspection shall be performed by a representative of a testing laboratory selected by the OWNER. OWNER will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.

C. CONTRACTOR shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.

D. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1705A.3.3.1. Waiver shall be in writing, including DSA approval. When batch plant inspection is waived by DSA, the following requirements shall be met:

1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weightmaster.

2. Licensed weightmaster shall positively identify materials as to quantity and certify to each load by a ticket.

3. Tickets shall be transmitted to the Inspector by a truck driver with load identified thereon. The Inspector will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to DSA.

4. At the end of the project, the weightmaster shall furnish an affidavit to DSA certifying that all concrete furnished conforms in every particular to proportions established by mix designs.

E. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, Reinforcement and Anchor testing per CBC Section 1910A and Specification Section 01 4523.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

B. Packaged materials shall bear the manufacturers and brand name label, and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

1.6 PROJECT CONDITIONS

A. Cold Weather Requirements: Batching, mixing, delivering and placing of concrete in cold weather shall comply with the applicable requirements of ACI 306.1.

B. Hot Weather Requirements: Batching, mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R.

C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C150. Portland Cement.

B. Aggregates: Conform to the following standards:

1. Normal weight concrete: ASTM C33.

2. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.

3. Nominal maximum size of coarse aggregate shall be no larger than:

a. 1/5 the narrowest dimension between sides of forms, nor

b. 1/3 the depth of slabs, nor

c. 3/4 the clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, or ducts.

d. CONTRACTOR may request the ARCHITECT and DSA waiver of the above limitations reported per ACI 318, provided that the workability and methods of consolidation are such that the concrete can be placed without honeycombs or voids.

C. Water: Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.

D. Admixtures: Shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 26.4.1.4.

1. Admixtures containing chlorides or sulfides are not permitted.

2. Air-entraining admixtures shall comply with ASTM C260. Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.

3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.

4. Admixtures for producing flowing concrete shall conform to ASTM C1017.

5. Fly ash, pozzolan and ground granulated blast-furnace slag:

a. Fly ash or other pozzolan used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:

1) Shall conform to ASTM C618 for Class N or F materials (Class C is not permitted).

2) Up to 15 percent by weight of fly ash or other pozzolans shall substitute for ASTM C150 Portland cement provided the mix design is proportioned per ACI 318, Section 26.4.3.

6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.

7. Silica fumes used as an admixture shall conform to ASTM C1240.

E. Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.

F. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.

G. Curing:

1. Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.

2. Elevated slabs and slabs on grade may be cured at CONTRACTOR's option with curing and proactive water vapor emission and alkalinity control system. Products shall be approved by OWNER's Office of Environmental Health and Safety.

a. VaporSeal 309, by Floor Seal Technology, Inc., or equal.

1) ASTM C156: 0.39 kg/m².

2) ASTM C309: Exceeds requirements.

3) ASTM C1315: Exceeds requirements.

4) ACI 308R-01 Compliant.

b. Remedial Treatment: Water vapor emission and alkalinity control treatment, MES 100 by Floor Seal Technology, Inc. or equal.

1) ASTM E96: <0.1 Perms.

2) ASTM D1308: 14pH Resistant.

3) ASTM D7234: 500+psi 100% concrete failure.

4) ASTM F2170: 100%RH resistant.

5) VOC Content: <100 g/L, meets SCAQMD Rule #1113.

6) ASTM F3010: Meets Requirements.

c. Self-leveling Compounds: Ardex Engineered Cements, K15, or V1200, Schonox ZM Rapid, US Self Leveler Armstrong, S-194, or equal.

H. Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.

I. Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from featheredge to a maximum of 3/8 inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed concrete surfaces and for underlayment of carpet, resilient, tile and quarry floor coverings. La-O-Tex by TexRite, Underlay C, RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.

J. Vapor Barrier: Refer to Section 07 2600, Vapor Barriers.

K. Stair Treads and Nosings: Two part stair tread and nosing with ribbed abrasive bars. Fabricated from 6063-T5 or 6063-T6 extruded aluminum, mill finish. Anti-slip abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Color shall extend uniformly throughout filler.

1. American Safety Tread: TP-311R.
2. Balco Inc.: DST-330.
3. Nystrom: STTB-P3.375E.
4. Wooster Products Inc.: WP-RN3SG.
5. Equal.

L. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.2 CONCRETE MIX

A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.

B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with minimum 28-day strength of 3000 psi (f'c).

C. Concrete mix shall meet the durability requirements of ACI 318, Chapter 19.

D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 26.4.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.

E. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

PART 3 - EXECUTION

3.1 GENERAL

A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.

B. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the Inspector at least 24 hours before placing concrete; do not place concrete until inspected by the Project Inspector.

C. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the ARCHITECT and DSA.

3.2 TOLERANCES

A. Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.

B. Floor Flatness (F_F) and Floor Levelness (F_L) shall be as indicated below:

	Specified Overall Value		Minimum Local Value	
	F_F	F_L	F_F	F_L
Slabs on ground: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	15	10
Slab on ground: carpet.	25	20	17	15
Slab on ground: thinset tile and resilient flooring.	35	25	24	17

C. Refer to ACI 302.1R, Tables 8.1 and 8.2 Slab on Ground and Suspended Flatness/Levelness Construction Guide, for recommended concrete placing and finishing methods.

D. Floor Flatness and Floor Levelness shall be tested in accordance to ASTM E1155. Floor measurements shall be made within 48 hours after slab installation, and shall precede removal of shores and forms.

3.3 PREPARATION

A. For installation of vapor barrier refer to Section 07 2600, Vapor Barriers.

B. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.

2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

C. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.4 INSTALLATION

A. Conveying and Placing:

1. Concrete shall be placed only under direct observation of the Project Inspector. Do not place concrete outside of regular working hours, unless the Inspector has been notified at least 48 hours in advance.

2. Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.

3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.

4. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.

5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

6. Concrete shall be thoroughly consolidated by suitable means during placement, and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

7. Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Cold Weather:

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.

2. The temperature of concrete at the time of placement shall not be below the minimum temperatures given in Table 3.1 of ACI 306.1.

3. Concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated

before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

C. Hot Weather:

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 26.5.5.

2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.

3. Cool concrete using methods indicated in ACI 305R Appendix B.

4. Place and cure concrete as specified in ACI 305R Chapter 4.

D. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.

2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

E. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

   a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.

   b. Floor of Gymnasium Locker Rooms: After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.

3. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

3.5 CURING

A. Length of time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 26.5.3.

B. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

C. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.

D. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.

E. When curing slabs with proactive water vapor emission and alkalinity control system:

1. Coordinate and schedule application of curing compound with concrete pour schedule, while conforming to manufacturer's application instructions.

2. When the surface of the concrete has hardened sufficiently to sustain foot traffic pre-cure slabs with liquefied product application following manufacturer's written instructions. Application shall be by trained applicators.

3. Monitor Environmental Conditions: Set up weather station 20 to 30 inches above freshly placed concrete. Record temperature, humidity and wind velocity measurements at 15 minute maximum intervals.

4. Calculate Evaporation Rate: Use recorded weather information in combination with nomograph per ACI 308R, Figure 4.1, Guide to Curing Concrete, to evaluate relevant evaporation rate.

5. When the bleed water rate of the concrete is approximately equal to the surface water evaporation rate, spray curing compound material throughout surface of slabs and decks, following manufacturer's written instructions. Application shall be by trained applicators.

6. Perform the following tests at least 28 days after placement of concrete and prior to floor covering installation. Submit to OAR test results indicating locations that do not comply with scheduled flooring installation requirements.

   a. Calcium chloride testing per ASTM F1869.

   b. Relative humidity testing per ASTM F2170.

   c. Alkalinity testing per ASTM F710.

   d. Perform concrete bond layer humidity meter testing to determine substrate surface acceptability.

7. Areas emitting moisture and alkalinity at rates exceeding floor covering manufacturer's published ASTM F1869 limits, shall receive a corrective coating, at no cost to the OWNER, as follows:

   a) Mask and protect adjacent walls and floor surfaces from effects of scarification and application of remedial treatment.

   b) Scarify slab surface in area of application by shot blasting or other method acceptable to corrective coating manufacturer.

   c) Prepare and fill cracks, control joints and cold joints.

   d) Apply two-component modified epoxy penetrant and coating with roller and squeegee over required treatment area; saturate surfaces to ensure a through mechanical bond.

   e) Clean and fill divots, chips, voids and other surface irregularities with one hundred percent Portland cement based patching compound or cementitious fill.

f) Apply cementitious surfacing over coating in areas to receive resilient and wood floor coverings to facilitate adhesion; apply to a thickness of 1/8 inch.

3.6 FILLING, LEVELING AND PATCHING

A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

C. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.7 FINISHING

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.

2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener.

1. Protect adjacent surfaces. Clean surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, laitance, dust and dirt are removed prior to application.

2. Apply hardener in accordance with manufacturer's instructions as soon as concrete is firm enough to work on after final troweling.

F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.8 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.

3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.9 TESTING

A. Molded Cylinder Tests:

1. Inspector or testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance to ASTM C172. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of three days, seven days, and 28 days. A strength test shall be the average of the compressive strength of two cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f'c.

3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31, and tested in accordance with ASTM C39.

B. Core Test: At request of the ARCHITECT, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.

1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the ARCHITECT.

2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.

3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.

C. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.

D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

E. Air Content Testing: Measure in accordance to ASTM C173 or ASTM C231, for each composite sample taken in accordance to ASTM C172.

F. Defective Concrete:

1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the ARCHITECT and DSA.

2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

G. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall have a minimum f'c = 3,000 psi. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 03 1000 Concrete Forming and Accessories, and reinforced as described in Section 03 2000 Concrete Reinforcing. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch maximum aggregate.

3.10 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 33 00 – ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Finishing formed decorative concrete surfaces (CONC-1 and CONC-4).
2. This Section supplements Section 03 30 00.

B. Related requirements:

1. Other Section of Division 03 for finishing concrete surfaces.
2. Division 07 for sealants.
3. Division 32 for finishing Portland cement concrete pavement outside building perimeter is specified in Section 32 13 00.

1.2 PREINSTALLATION CONFERENCE:

A. Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Require representatives of each entity directly concerned with cast-in-place architectural concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Ready-mix concrete manufacturer.
    c. Waterproofing manufacturer’s representative.
    d. Cast-in-place architectural concrete subcontractor.

2. Review concrete design mixture and examine procedures for ensuring quality and consistency of concrete materials. Review hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of concrete.

1.3 STANDARDS

A. Comply with the requirements of the structural requirements of Sections 03 31 00 and 03 30 00 Cast-in-Place Concrete, Reinforcement & Formwork Sections, and as specified herein.

1.4 DEFINITIONS

A. Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure and that requires special concrete materials, formwork, placement or finishes to obtain specified architectural appearance. Surfaces of architectural concrete elements that are not exposed to view in the completed work, need not conform to requirements of this Section.

1.5 SUBMITTALS

A. Data: Manufacturer Product Data, including installation instructions where applicable, for the following items.

1. Curing and curing/hardening compounds.
2. Curing paper.
3. Bonding agents.

4. Control joint filler.

B. Design mixtures. Indicate amounts of mixing water to be withheld for later addition at the site.
C. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect architectural concrete.

1. Indicate and call special attention to butted form joints. Indicate method of sealing joints and maintain alignment.
2. Review of formwork drawings is only for features affecting visual quality.

D. Placement schedule indicating locations of all construction joints.
E. Samples for Board Form Material Selection:

1. Match Architect's sample pattern and texture.
2. Submit samples at least 30 days prior to constructing mock-up panels.
3. Submit three 24 inch long samples representative of the range of material to be expected for each width and finish.
4. Based on review of samples, Architect will identify boards to be used for field sample panels.

F. Mockup for formed concrete work:

1. After all Samples, Product Data, and the Shop Drawings for the mockup are approved, construct mockups of the CIPAC in a location approved by the Architect as specified below.
2. Mockups and mockup submissions for the concrete work shall consist of the following:

    a. Mockup showing the following: Board-formed planter wall (CONC-1).
    b. Additional mockups or partial mockups shall be required if the above mockups are deficient in producing the quality required for the Project.

3. Mockup of board-formed concrete planter wall shall consist of the following:

    c. Foundation of a size and reinforcement adequate to support the work.
    d. Scope of mockup:

        1) 3-ft by 6-ft "L" shaped planter wall.

            a) One vertical construction joint in wall.
            b) One horizontal construction joint in wall.
            c) Form ties with layout as shown in the wall.

    e. Reinforce as in a similar detail on the Drawings and add necessary reinforcement and/or supports to maintain stability.
    f. Use approved form face materials, reinforcement and accessories and assemble formwork as intended for the building construction
    g. Place concrete in the wall with methods to be used for typical long wall in building, including anticipated time delays between deposit lifts.
    h. Finish exposed hardened surfaces of the walls with specified finish treatments when directed by the Architect and with the Architect present. Finish wall with minimum 2 feet wide areas as directed by the Architect.
    i. Use same concrete mix design for the mockup as will be used in the construction of the final board formed walls.

4. If mockups are rejected by the Architect, remove and replace them at no cost to the Owner.

j. Locate mockups so they will remain throughout construction. Protect mockup from damage at all times; remove when directed by the architect.

G. Concrete mix designs: As specified in Section 03 30 00, "Cast-in-Place Concrete" and as specified herein.

1.6 QUALITY ASSURANCE

A. The work of this Section shall be performed by a concrete subcontractor specialized in the type of architectural cast-in-place concrete work required for this Project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly trained in the necessary crafts to perform architectural concrete work.

1. The cast in place concrete subcontractor, carpenter foreman, labor foreman and the reinforcement erector foremen shall have successful experience in performing cast-in-place concrete work that shows the ability to perform architectural quality work and shall be approved for work on project. Submit projects, including name, description of responsibilities, scope of work, and references.

B. Concrete quality control technician: Assign a quality control person to oversee the architectural concrete work. The primary duty is to be responsible for the required execution of the work. The Concrete Quality Control Technician shall develop a check list for execution of the work and for sign off by the concrete superintendent and be submitted to the Architect.

1. Board-formed concrete vertical surfaces (CONC-1).
2. Smooth-sacked concrete finish (CONC-1).

1.7 HANDLING/PROJECT CONDITIONS

A. Protect adjacent surfaces from staining and damage by covering them with impermeable coverings securely taped in place.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. As specified in Section 03 30 00.
B. See CONC-1 and CONC-4 on sheet A610 -Interior Finish Materials sheet.
C. Water: Fresh, clean, and free of oil and other materials injurious to concrete.

2.2 CURING COMPOUNDS

A. See Section 03 30 00 for general curing materials.

2.3 MISCELLANEOUS MATERIALS

A. Board-formed materials:

1. Board Forms: Textured wood boards of species and surface finish to be selected based on sample panel program. Select material for straightness and appearance characteristics matching approved samples. Take measures, as necessary, to prevent warping and cupping of boards prior to formwork removal. Take measures as necessary to obtain desired appearance of seams between adjacent boards.
2. Material: Douglas Fir, FAS Grade, free of knots

3. Backing Panels (for board-forms): PS 1 plywood, minimum 19/32 inch thick, edge sealed, exterior exposure. Seal surface to prevent absorption of moisture.
4. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch thick.
5. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS, that adheres to form joint substrates.
6. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of chemicals from wood.
7. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.
8. Form Ties: Factory-fabricated, internally disconnecting or removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal. Ties shall be sealed to prevent staining at exposed face associated with loss of moisture.
9. Provide types and strengths required for each condition.
10. Furnish ties with tapered tie cone spreaders that, when removed, will leave holes 1 inch in diameter on concrete surface.
11. Furnish ties with integral water-barrier plates, when surface is exposed to weather.
12. Steel left in the concrete shall be at least 1 1/2 inches back from surfaces exposed to weather and 1 inch back from other surfaces.
13. Subject to providing necessary strength to resist concrete pressure, Dayton Superior A3 snap ties, with 1 x 1 1/2-inch A 2 plastic cones and A8 waterseal washers, or equal.

B. Bonding agent (non-structural)): ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene, Acryl-Bond by Atlas Tech Products or equal.
C. Skim coat: Use the following in lieu of sacking.

1. Ardex Titl Wall Patch.
2. Rapid Set UnderFixx or Wunderfixx.
3. Euclid Chemicals Tammscrete.
4. WR Meadows Speed Crete.Noxcrete Panel Patch.
5. Joint filler: Homex Expansion Joint by Homasote Co. or equal non-bituminous product compatible with sealant specified in Section 07 92 00. Use in combination with plastic joint cap made by Greenstreak or equal.
6. Joint sealant and back-up rod: As specified in Section 07 92 00.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Finish concrete surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.
B. Tolerances: Use Fl and Ff numbers. Do not use straightedge method. Do not use Fl numbers for suspended slabs.

C. Where concrete finishing occurs adjacent to finished metal and similar surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing concrete to harden.
D. Use no troweling machines within 12 inches of electrical junction and outlet boxes set to finish flush with concrete floors.

1. Float and trowel such areas by hand with wood floats and steel trowels, using caution so that concrete is finished flush with box cover and matches adjacent surfaces.

E. Concrete finish will be considered defective and shall be repaired, when the repairs are acceptable to the Architect, or removed and replaced with proper work conforming to Contract Documents, at no additional cost to Owner, when:

1. It does not match approved sample panels.
2. It is not true to lines and planes.
3. It is not properly troweled and surfaced as required and varies in excess of tolerances specified.
4. Is scuffed or has a rough surface, except where required.
5. Does not connect properly to adjoining work.
6. Does not slope consistently to drains (has bird baths).
7. Is not properly cured.

3.2 FORMWORK

A. General: Comply with Section 03 10 00, “Formwork”, except where more stringent requirements are specified herein. Requirements for formwork apply only at exposed to view surfaces; other surfaces shall conform to requirements for structural concrete.

B. Preparation of Form Surfaces: Apply form sealer to all wood form surfaces to prevent absorption of moisture.

C. Design formwork to permit easy removal. Prying against the concrete surface will not be permitted.

1. Provide 1:6 draft on rustication strips to facilitate removal.

D. Formwork shall be strong enough and sufficiently rigid to withstand pressures that result from rapid filling and high frequency consolidation.

1. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.

E. Design and construct form work to be water tight under full head hydrostatic pressure of the section to be placed as well as the action of the specified consolidation techniques.

1. Take particular care to seal penetrations, including form ties.

F. Layout form joints, reveals, ties as shown on the Drawings and plumb and true to line. Locate vertical construction joints behind rustications and away from corners.

G. Nail or screw heads shall not occur at contact surface with concrete. Form surfaces in contact with concrete shall be screw attached from backside, glued, or fastened using other approved method.

H. Form exposed architectural faces first. Indicate butted form joints on shop drawings and locate in field only as shown on the approved shop drawings. Perform work necessary to align and seal joints of abutting panels prior to placement of reinforcement.

1. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, to Class A, 1/8 inch.

I. Board-Form Finish: Construct formwork with wood plank face forms secured to minimum 5/8-inch-thick plywood backing panels. Bond face layer and back-up panels together with waterproof contact glue or screwed together from back side so as not to penetrate the finished face.

1. Splice boards only at locations shown.
2. Fit edges of boards as approved by Architect. Place foam gaskets between adjacent boards, held back 1/8 inch from contact surface.

J. Coat contact surfaces of forms with a light uniform coating of form-release agent, according to manufacturer's written instructions, before placing reinforcement.

1. Do not allow excess form-coating materials to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.
2. Coat forms with release agent prior to erection, where coating cannot be applied in place.

3.3 MARKINGS

A. At control joints and elsewhere as indicated, provide markings with a rounded edging or marking tool, to a 1/4-inch radius. In textured work, edge and mark with a combination edging and smoothing tool approximately 1-1/2-inch wide.
B. Make markings within a tolerance not exceeding 1/4-inch in 10 feet.
C. Where indicated, provide cut markings sawn into surface of cured concrete. Coordinate this work with the work of other Sections to avoid damage to adjacent surfaces.
D. Complete sawcutting within 16 hours after casting.
E. Use sawcutting equipment specifically designed to cut 1/8-inch-wide joints crisp, sharp, unchipped edges in newly cast concrete. Use cutting machine with a high speed (10,000 rpm minimum), self-propelling without forcing the speed, with a 4-inch blade specially made for green concrete. Equipment and blades made by Soff-Cut Corp., Corona, CA, or equal that will provide similar results.
F. Make marking lines straight, or curved where required by the Drawings, equally spaced and parallel to adjacent lines and walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed. Continue markings to vertical surfaces interrupting the flatwork.

3.4 BUILT-IN ITEMS

A. Set items furnished under this or other Sections and finish to floor fixtures and other floor features as indicated. Adjust finish to properly connect and fit to other work. Slope floor to drain where indicated.
B. Floor drains and other items furnished and installed under other Sections: Finish concrete surface flush with rims unless detailed otherwise.
C. Exercise particular care with respect to drains to ascertain that they are installed at proper elevations to permit drainage. Do not proceed until corrective work is performed and accepted.

3.5 CONCRETE PLACEMENT

A. Placement in accordance with Chapter 6, ACI 304 and Chapter 7, ACI 303R and the following:
B. Depositing Concrete:

1. Deposit concrete using pump hoses or tremies inserted into the form cavity to minimize segregation and accumulated concrete on formwork and reinforcement. Do not drop concrete more than 30 inches.
2. Deposit concrete continuously between joints in layers not exceeding 30 inches in height and in a manner to avoid inclined lift lines.

    a. First layer of concrete placed against hardened concrete shall not exceed 24 inches in height.

3. Allow fresh face to stand not more than 15 minutes prior to placement of succeeding layer.

C. Consolidating Concrete:

1. Consolidate placed concrete with internal vibration according to ACI 303.1.

2. Use two vibrators at each placement. Optimum size of vibrator head shall be 1 inch to 1 1/2 inches.
3. Do not use vibrators to transport concrete in forms.
4. Vibrators shall be placed into the concrete vertically at a consistent spacing that will thoroughly blend deposits, remove entrapped air and consolidate concrete. Vibrator head shall be inserted rapidly and penetrate at least 12 inches into preceding layer, then withdrawn slowly and uniformly to blend layers and remove a maximum amount of entrapped air.
5. After top layer is placed, the concrete shall be allowed to set for 10 to 15 minutes and then given a final vibration of the top 24 inches.
6. Do not place vibrators against formwork.

3.6 FINISHING FORMED SURFACES

A. General:

1. Remove fins, laitance and loose materials from concrete surfaces when forms are removed.
2. Repair honeycombs, rock pockets, sand runs, spalls and other damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate.
3. Fill-in tie holes with the same mix as the adjacent concrete minus the coarse aggregate.
4. Tamp and float, or trowel patches flush with adjacent surface and to match adjacent concrete texture.

B. Grout cleaned finish (CONC-1): This finish may be indicated as “Smooth Sacked” on the Drawings.

1. No form pattern shall be visible after surfaces are finished as specified.
2. Provide grout cleaned finish to surfaces that have received smooth form finish treatment.
3. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
4. Thoroughly wet the concrete surface and apply grout uniformly by brushing or spraying immediately on the wet surfaces.
5. Scrub surface with cork float or stone to coat surface and completely fill surface holes.
6. Remove excess grout by scraping, followed by rubbing with clean burlap and remove any visible grout film.
7. Keep grout damp during setting period by means of fog spray at least 36 hours after final rubbing.
8. Complete any area the same day it is started to a natural break such as a corner.
9. In lieu of the above, Contractor may skim coat concrete surfaces using one of the premixed material specified above, after providing a satisfactory sample panel in a location acceptable to the Architect.

C. Related unformed surfaces:

1. At tops of wall, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with textured matching the adjacent formed surfaces.
2. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surface, unless otherwise shown.

D. Curing:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound Type II applied as specified for curing compound Type III for flatwork below.

3.7 CURING - GENERAL

A. See Section 03 30 00.
B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
C. Where supplementary cementitious materials are used, take extra precautions to prevent premature drying. Where fly-ash replacement is 35% or higher, floor slabs shall receive at least a 3-day moist cure before application of a curing compound. Other surfaces with the exception of foundations shall receive the approved curing compound immediately after removal of formwork.

3.8 BOARD-FORM REMOVAL AND CURING

A. Use consistent stripping time and curing method for exposed surfaces. Maintain surface appearance that matches approved field sample panels and mockups.
B. For surfaces exposed to weather, leave formwork securely in place for 7 days and cover exposed top surface tightly with impervious sheeting.
C. In hot weather, cover forms during curing period to protect from direct sunlight.
D. Thoroughly wet surface immediately after loosening forms and again after form removal.

3.9 BOARD-FORMED FINISHING

A. General: Match approved mockup, identified and described as indicated, to satisfaction of Architect.
B. As-Cast Formed Finishes: Concrete shall have uniform as-cast surface with minimal additional finishing being anticipated or required. Remove fins and projections, where necessary, by grinding without marring adjacent surface. Repair honeycombed concrete and other defects; surface blemishes will not be filled. Fill tie holes and strike flush with adjacent surfaces.

1. Type 1 Finish: Board formed with 7-1/4” wide boards oriented vertical.

C. Fill tie holes with patching mortar, recessing 1/2 inch from finished surface.
D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
E. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
F. Maintain uniformity of finishes, including alignment of boards, over construction joints, unless otherwise indicated.

3.10 MOISTURE CONTROL

A. In addition to finishing requirements specified, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and high temperature exist, or use evaporation retarder specified.

1. Immediately after wet concrete has been leveled, or sloped as required, and the shiny film of moisture disappears, start fog spraying and continue until final troweling, by applying a light film of moisture with an atomizing type sprayer.
2. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and frequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

3.11 PATCHING

A. Do not patch any area without specific approval from the Architect on a case-by-case basis.
B. Develop patching technique on mock-up prior to patching in-place concrete for review and approval by the Architect. Use only the same mix for patching as finally developed for the approved sample on the mock-up.
C. Remove all loose concrete prior to patching and thoroughly wet the surface to prevent moisture loss form the patch mix.
D. Pack patch mix into the void and hand dress to match texture and color of adjoining concrete.

3.12 ADJUSTING/CLEANING

A. Clean architectural concrete surfaces to remove gasket adhesives, markings, laitance, dust, and debris.
B. Protect corners, edges, and surfaces of architectural concrete from damage. Pay particular attention to surfaces near the work of other trades.
C. Protect concrete from staining during remainder of construction period, including rust, paint, and oils.
D. Wash and rinse surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
E. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.
F. Protect exposed concrete work as necessary to prevent damage resulting from impact or from subsequent work or rubbish.
G. Protect adjacent work from damages by this work with heavy Kraft paper or polyethylene film.
H. Maintain protection in effective condition for as long as need for protection exists.
I. Control use of water within the building so that no damage to previously installed work or existing structures and finish occurs.

3.13 FORM REUSE

A. Forms shall not be reused for architectural concrete, if there is evidence of surface wear, or other defects that would impair the quality or consistency of appearance of the surface.
B. Board forms shall not be reused.

3.14 FIELD QUALITY CONTROL

A. Conduct a water test, in the Architect’s presence to verify that flatwork drains away from the building and that water flows to drains.
B. Correct non-conforming concrete, or remove and replace defective paving, to the Architect’s satisfaction.

C. Except as specified, acceptance of structure for dimensional tolerances, appearance, and strength will be based on ACI-301, Chapter 18.

END OF SECTION

SECTION 03 35 00 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Finishing formed decorative exterior concrete surfaces.
2. This Section Supplements Section 03 30 00.

B. Related requirements: Division 07 for sealants.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data, including installation instructions where applicable, for the following items.

1. Curing and curing/hardening compounds.
2. Curing paper.
3. Bonding agents.
4. Patching and surfacing compounds.
5. Abrasive aggregates.
6. Control joint filler.
7. Concrete wall polishing equipment and operator qualifications.

1.3 QUALITY ASSURANCE

A. Installer qualifications: Qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Field Samples: Provide 4-foot by 4-foot Field Samples of each concrete finish specified for the Architect's approval prior to commencing concrete work. Repeat sample panels if first ones prove unsatisfactory. Locate Field Samples where directed at the site.

1. Broom, float and trowel finishes.
2. Sandblasted finish; CONC-2.

1.4 HANDLING/PROJECT CONDITIONS

A. Protect adjacent surfaces from staining and damage by covering them with impermeable coverings securely taped in place.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. As specified in Section 03 30 00.

B. Water: Fresh, clean, and free of oil and other materials injurious to concrete.

2.2 ADMIXTURES AND PIGMENTS

A. Admixtures for colored concrete: Only air-entraining admixture permitted.

2.3 CURING COMPOUNDS

A. General: Curing, hardening and sealing agents to be applied sequentially shall be products of single manufacturer. Where products of different manufacturers are used including proprietary topping and surfacing materials, confirm their compatibility with respective manufacturers. Mask areas to receive sealants, caulking compounds or special paints/epoxy/waterproofing/coatings before application of curing or sealing agents.

1. Compound shall produce a uniform, continuous, adherent film that does not check, crack, or peel and is free from pinholes or other imperfections. Cure permanently exposed surfaces with a clear-type membrane-forming curing compound containing a fugitive dye.
2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age.
3. Curing compound for use on concrete floors to receive adhered covering shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives. Refer to the Finish Schedule on the Drawings for specific finish materials and areas of application.

B. Type I, moist cure only: Rollout waterproof covering complying with ASTM C 171, SK-10 by Fortifiber Corp. or equal.

C. Type II cure only: Quantum Cure by Atlas Tech Products, or equal. ASTM C 309 Type 1, Class A and B, liquid membrane-forming, non-penetrating, compound with fugitive dye for exterior use; for interiors use curing compound without a fugitive dye.

1. Horncure 30D by AC Horn, Inc.
2. Hydrocide Curing 309 Resin-Base by Sonneborn-Rexnord.
3. Kurez E-100S by Euclid Chemical Co.
4. Day-Chem Rez Cure by Dayton Superior.
5. Or equal.

D. Type III, cure and seal: Apply one coat for curing and second coat for sealing.

1. Elite-HS by Atlas Tech Products.
2. Dekote by WR Grace.
3. Polyclear by Upco Co., Division of USM.
4. Eucocure by Euclid Chemical Co.
5. Sure-Klean Cure & Seal by ProSoCo, Inc.
6. Kure-N-Seal by Sonneborn-Rexnord.
7. Or equal.

E. Type IV, Moist Cure, Hardener & Sealer:

1. Ashford Formula by Curecrete Chemical Co., Inc.
2. Lapidolith hardener” by Sonneborn-Rexnord.
3. “Hornolith hardener” by AC Horn, Inc.
4. Saniseal 100 hardener by Master Builder.
5. Day-Chem Sure Hard by Dayton Chemical.
6. Euco Diamond Hard by Euclid Chemical Co.
7. Surfhard hardener by The Euclid Chemical Co.
8. Or equal.

F. Lithium silicate sealer/hardener: Consolidec LS or LS/CS penetrating compound by ProSoCo, or equal. Apply before curing compound.

G. Curing compound for colored concrete: Lithochrome Colorwax by LM Scofield Co., or equal. Color to match that of the color hardener.
H. Surface sealer: Consolideck LS Guard, polymer-modified lithium silicate for interior floors, or equal. Apply in 3 coats and burnish.
I. Surface sealer: Consolideck Polishguard, acrylic sealer for interior floors, or equal. Apply in 2 coats.

2.4 MISCELLANEOUS MATERIALS

A. Bonding agent (non-structural)): ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene, Acryl-Bond by Atlas Tech Products or equal.
B. Skim coat: Use the following in lieu of sacking.

1. Ardex Tilt Wall Patch.
2. Rapid Set UnderFixx or Wunderfixx.
3. Euclid Chemicals Tammscrete.
4. WR Meadows Speed Crete.Noxcrete Panel Patch.
5. Joint filler: Homex Expansion Joint by Homasote Co. or equal non-bituminous product compatible with sealant specified in Section 07 92 00. Use in combination with plastic joint cap made by Greenstreak or equal.
6. Joint sealant and back-up rod: As specified in Section 07 92 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Joints in flatwork:

1. Set premolded expansion joint strip below finished surface with a slightly tapered, dressed, wood strip, temporarily secured to top of expansion strip to provide space for sealant, or use an extruded plastic strip, approved by the Architect.
2. Install expansion joints in straight or curved lines as indicated within a tolerance not exceeding 1/4-inch in 10 feet.
3. After concrete finishing operations are completed, and concrete is cured, fill void formed by the strip with sealant as specified in Section 07 92 00. Provide joints where indicated and in all cases where concrete flatwork abuts vertical elements such as walls, columns and curbs.

3.2 GENERAL REQUIREMENTS

A. Finish concrete surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.

1. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface. Perform minimum of 2 tests for each slab and finish; one at initial pour and the second randomly chosen by testing laboratory.

a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
b. .

B. Where concrete finishing occurs adjacent to finished metal and similar surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing concrete to harden.

C. Use no troweling machines within 12 inches of electrical junction and outlet boxes set to finish flush with concrete floors.

1. Float and trowel such areas by hand with wood floats and steel trowels, using caution so that concrete is finished flush with box cover and matches adjacent surfaces.

D. Concrete stairs:

1. As soon as concrete is set up sufficiently to permit working, remove riser forms and finish treads and risers in a continuous operation, working from top to bottom.
2. Slope treads 1/8-inch from base of riser to nosing, run nosings straight and level to template.
3. Finish nosings and coves at junction of treads and vertical surfaces to a uniform profile throughout. Where abrasive nosings are indicated, embed them in the fresh concrete, level and centered on the tread.

E. Concrete finish will be considered defective and shall be repaired, when the repairs are acceptable to the Architect, or removed and replaced with proper work conforming to Contract Documents, at no additional cost to Owner, when:

1. It does not match approved sample panels.
2. It is not true to lines and planes.
3. It is not properly troweled and surfaced as required, and varies in excess of tolerances specified.
4. Is scuffed or has a rough surface, except where required.
5. Does not connect properly to adjoining work.
6. Does not slope consistently to drains (has bird baths).
7. Is not properly cured.

3.3 MARKINGS

A. At control joints and elsewhere as indicated, provide markings with a rounded edging or marking tool, to a 1/4-inch radius. In textured work, edge and mark with a combination edging and smoothing tool approximately 1-1/2-inch wide.
B. Make markings within a tolerance not exceeding 1/4-inch in 10 feet.
C. Where indicated, provide cut markings sawn into surface of cured concrete. Coordinate this work with the work of other Sections to avoid damage to adjacent surfaces.
D. Complete sawcutting within 16 hours after casting.
E. Use sawcutting equipment specifically designed to cut 1/8-inch wide joints crisp, sharp, unchipped edges in newly cast concrete. Use cutting machine with a high speed (10,000 rpm minimum), self propelling without forcing the speed, with a 4-inch blade specially made for green concrete. Equipment and blades made by Soff-Cut Corp., Corona, CA, or equal that will provide similar results.
F. Make marking lines straight, or curved where required by the Drawings, equally spaced and parallel to adjacent lines and walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed. Continue markings to vertical surfaces interrupting the flatwork.

3.4 BUILT-IN ITEMS

A. Set items furnished under this or other Sections and finish to floor fixtures and other floor features as indicated. Adjust finish to properly connect and fit to other work. Slope floor to drain where indicated.
B. Floor drains and other items furnished and installed under other Sections: Finish concrete surface flush with rims unless detailed otherwise.

C. Exercise particular care with respect to drains to ascertain that they are installed at proper elevations to permit drainage. Do not proceed until corrective work is performed and accepted.

3.5 FINISHING FORMED SURFACES

A. General:

1. Remove fins, laitance and loose materials from concrete surfaces when forms are removed.
2. Repair honeycombs, rock pockets, sand runs, spalls and other damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate.
3. Fill-in tie holes with the same mix as the adjacent concrete minus the coarse aggregate.
4. Tamp and float, or trowel patches flush with adjacent surface and to match adjacent concrete texture.

B. Rough form finish:

1. Provide as-cast rough form finish to formed concrete surfaces that will be concealed in the finish work or by other construction, unless otherwise indicated.
2. Standard rough form finish shall be concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4-inch high rubbed down or chipped off.

C. Smooth form finish:

1. Provide as-cast smooth form finish for formed concrete surfaces that will remain exposed-to-view, or that will be covered with a material applied directly to the concrete, or a material bonded to the concrete such as waterproofing, painting, and similar system.
2. Select form material to impart a smooth, hard, uniform texture and arrange forms in an orderly and symmetrical pattern, with a minimum of seams.
3. Repair and patch defective areas with fins or other projections completely removed and smooth.

D. Smooth rubbed finish:

1. Provide smooth rubbed finish to concrete surfaces so indicated, not later than the day after form removal.
2. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced.
3. Do not apply cement grout other than that created by the rubbing process.

E. Grout cleaned finish: This finish may be indicated as “Sack and Rub” on the Drawings.

1. No form pattern shall be visible after surfaces are finished as specified.
2. Provide grout cleaned finish to surfaces that have received smooth form finish treatment.
3. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
4. Thoroughly wet the concrete surface and apply grout uniformly by brushing or spraying immediately on the wet surfaces.
5. Scrub surface with cork float or stone to coat surface and completely fill surface holes.
6. Remove excess grout by scraping, followed by rubbing with clean burlap and remove any visible grout film.

7. Keep grout damp during setting period by means of fog spray at least 36 hours after final rubbing.
8. Complete any area the same day it is started to a natural break such as a corner.
9. In lieu of the above, Contractor may skim coat concrete surfaces using one of the premixed material specified above, after providing a satisfactory sample panel in a location acceptable to the Architect.

F. Related unformed surfaces:

1. At tops of wall, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with textured matching the adjacent formed surfaces.
2. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surface, unless otherwise shown.

G. Abrasive blasting (sandblasting):

1. Sandblast accent paving panels indicated on the Drawings to expose fine aggregates with occasional exposure of coarse aggregate for a 1/16-inch aggregate exposure.
2. Protect corners with boards when sandblasting so that they remain sharp.
3. Remove loose aggregates, after desired exposure is achieved, with clean air under pressure.

H. Curing:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound Type II applied as specified for curing compound Type III for flatwork below.

3.6 COMPACTING AND FLOATING FLATWORK

A. Bring slabs with monolithic finish to proper level using screeds and strike off with a straightedge. Remove excess water and laitance.

1. Compact and consolidate to embed coarse aggregates.
2. Float and test surfaces with a 10-foot straightedge and eliminate high and low spots to comply with tolerances specified.
3. From this point, use methods and tools necessary to produce surface finish specified.

B. Use continuous screeds of such type and construction and so spaced and located as to produce surface tolerances specified.

3.7 CURING - GENERAL

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
B. Where supplementary cementitious materials are used, take extra precautions to prevent premature drying. Where fly-ash replacement is 35% or higher, floor slabs shall receive at least a 3-day moist cure before application of a curing compound. Other surfaces with the exception of foundations shall receive the approved curing compound immediately after removal of formwork.

3.8 METHODS OF FINISHING AND CURING FLATWORK

A. Water curing Type I: For surfaces to receive concrete topping, bonded cementitious setting beds, thin-set ceramic and paver tiles, and elastomeric floor coating. Except for surfaces to receive bonded cementitious topping or setting bed, curing compound may be used in lieu of water curing provided that the Contractor certify in writing to the Owner that the compound will not interfere with mortar setting beds (for tiles and pavers) and elastomeric floor coating performance and longevity.

1. After troweling and as soon as it can be done without marring finish, lay curing paper, lap seams 3 inches and seal with pressure-sensitive tape.
2. Keep concrete continuously moist for 14 days minimum. Leave paper in place as temporary protection as long as possible.

B. Curing/hardening compound Type IV: For interior slabs not scheduled to receive a deferred finish.

1. After troweling or finishing and as soon as it can be done without marring the finish, spray curing and hardening compound uniformly in compliance with its manufacturer instructions submitted to the Architect, as specified in Article 1.3 of this Section.
2. When the manufacturer recommends a coverage range, use the heavier application unless otherwise acceptable to the Architect.
3. Examine at regular intervals that the compound film is intact. If damaged, moisten the concrete and apply additional compound.

C. Curing compound Types II and III: For all other concrete flatwork.

1. Promptly after troweling or finishing, apply curing compound uniformly by spray as described above for sealer.
2. Examine at regular intervals that the compound film is intact. If damaged, moisten the concrete and apply additional compound.

D. Protection: Unless otherwise recommended by the curing compound manufacturer, restrict traffic on treated slabs for a minimum of 8 hours under normal atmospheric conditions.

3.9 MOISTURE CONTROL

A. In addition to finishing requirements specified, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and high temperature exist, or use evaporation retarder specified.

1. Immediately after wet concrete has been leveled, or sloped as required, and the shiny film of moisture disappears, start fog spraying and continue until final troweling, by applying a light film of moisture with an atomizing type sprayer.
2. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and frequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

3.10 FLATWORK FINISHES

A. Integral float finish:

1. Use for curbs, gutters, surfaces to receive roofing and waterproofing membrane, and ceramic and paver tile whether on conventional setting bed over a cleavage membrane or dry-set over concrete slab.

2. After screeding and compacting, finish with a wood float using a rotary or darbied circular motion to produce a uniform texture and finish throughout.

B. Integral smooth steel trowel finish:

1. Use for surfaces to receive carpet, resilient flooring, and surfaces that have no other specific finish specified.
2. Trowel surface until the slabs are finished to a smooth, hard, burnished surface.
3. Consolidate the concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance specified. Grind smooth surface defects that would telegraph through applied floor covering system.
4. Where surfaces will receive elastomeric coating and thin set tiles, in lieu of the final troweling, brush surface lightly with a broom or floor brush as recommended by the coating manufacturer. Coordinate finishing operations with the trades applying the elastomeric coating and performing the tile work.

C. Raked or scratched finish:

1. Use for surfaces to receive a bonded topping slab or cementitious setting bed.
2. After screeding and compacting, roughen finish with a garden rake or other appropriate tool to provide a mechanical bond for topping slabs.

D. Broom finish:

1. After screeding, compacting and floating, sweep the finish with a coarse broom, against a straightedge at right angle to the slope or direction of travel, to produce a uniform non-skid surface with the depressions parallel and at a uniform depth.
2. Time this operation to texture slabs at the same age to obtain a uniform finish throughout.

E. Abrasive aggregate finish:

1. Apply abrasive aggregates after first troweling, at uniform rate of not less than 25 lb./100 sq.-foot.
2. After second troweling rub surface of concrete with steel wool pads to remove cement film and expose the aggregates uniformly, or treat surface with a 10 percent solution of muriatic acid.
3. Wash the acid completely from the concrete after treatment and dispose of it legally

3.11 CONCRETE SAW CUTTING

A. Discharge of water, dust or debris from concrete saw cutting to storm or sanitary systems is prohibited. Protect storm and sanitary drains from clogging by dust and debris.

1. Contain and collect water used in concrete saw cutting and sweeping for proper disposal. Suggested controls include wet vacuum and/or absorbents.
2. Use good housekeeping practices at the jobsite. Minimize dust.

3.12 ADJUSTING/CLEANING

A. Protect exposed concrete work as necessary to prevent damage resulting from impact or from subsequent work or rubbish.
B. Protect adjacent work from damages by this work with heavy Kraft paper or polyethylene film.
C. Maintain protection in effective condition for as long as need for protection exists.
D. Control use of water within the building so that no damage to previously installed work or existing structures and finish occurs.

3.13 FIELD QUALITY CONTROL

A. Conduct a water test, in the Architect's presence to verify that flatwork drains away from the building and that water flows to drains.
B. Correct non-conforming concrete, or remove and replace defective paving, to the Architect's satisfaction.
C. Except as specified, acceptance of structure for dimensional tolerances, appearance, and strength will be based on ACI-301, Chapter 18.

END OF SECTION

SECTION 03 35 53 - INTERIOR CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Surface preparation.
2. Application of clear concrete sealer (CONC-5) on exposed surfaces of the interior concrete floors where indicated.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting:

1. Prior to start of installation, arrange a pre-installation meeting between the sealer manufacturer, the applicator, and related trades whose work will be in contact with the treated surface, including but not limited to those for colored concrete and joint sealers.
2. Record minutes of the meeting, file in the Project file, and send a copy to the Architect.

B. Phasing

1. Where feasible delay sealer application until installation of sealants is complete in joints adjoining surfaces to be coated.
2. Sealer work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, sealer, and sealant materials identical to those used in the Work.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data of the proposed sealer, including recommended coverage rates, include material test reports indicating and interpreting test results for compliance of water-repellent sealer with criteria specified.

B. Manufacturer certification:

1. Letter from the sealer manufacturer to verify its acceptance of the applicator, acceptance of substrates as satisfactory to receive the specified sealer, and affidavit that sealer is compatible with concrete curing agent used.
2. Duplicate copies of manufacturer affidavit with each shipment of materials delivered to the jobsite certifying that material furnished complies with specified requirements.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Firm with a minimum of 3 consecutive years of experience in application of the sealer proposed for use, or similar sealers, on projects of similar size and scope, and licensed or approved in writing by the sealer manufacturer.

B. Sample panels: When requested by the sealer manufacturer, or necessary to adjust sealer formulation, provide sealer manufacturer with sufficient samples of substrate to be coated to determine exact formulation and coverage rates.

C. Manufacturer inspections:

1. Obtain materials only from manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability. Schedule subsequent visits as required thereafter to review installation procedures and completed work, and to issue warranty specified.

2. Unsatisfactory conditions disclosed by the manufacturer visits to the site shall be promptly and satisfactorily repaired and the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

1.5 JOB CONDITIONS

A. Comply with manufacturer's recommendations regarding environmental requirements, and temperature and conditions of surfaces to receive sealer.

PART 2 - PRODUCTS

2.1 SEALER/MANUFACTURER

A. Finish Concrete Sealer: See CONC-5 on sheet A610 -Interior Finish Materials sheet.
B. Basis of design is Liqui-Hard Ultra manufactured by W. R. Meadows or equal by one of the following:

1. Consolideck LS by Prosoco,
2. Hydrozo Silane 40 VOC by BASF.
3. Seal Hard by L&M Construction Chemicals, Inc.
4. L3000 by Pecora Corp.
5. Or equal.

2.2 PERFORMANCE REQUIREMENTS

A. Provide sealer with the following properties based on testing manufacturer standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens for hardened concrete: ASTM C 642.
2. Water-vapor transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, ASTM E 96.
3. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, ASTM G 53.
4. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, ASTM D 1653.

B. Appearance: When compared visually to an untreated sample under same lighting conditions, the sealer shall not change the color and sheen of the coated substrate and shall be invisible after application and over the life of the building.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain the services of a factory-authorized technical service representative, from the sealer manufacturer, to inspect and approve the substrates before application and to instruct the applicator on the product and application method to be used.
B. Verify that slabs to be sealed are clean, dry and free of dust, dirt, oil, grease and other foreign material that would affect the application and performance of the sealer.
C. Correct detrimental conditions before proceeding with installation.

3.2 PROTECTION

A. Protect adjacent work, including sealant bond surfaces, from spillage or blow-over of sealer.

3.3 APPLICATION

A. Test application:
   1. Before performing this work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application.
   2. Proceed with work only after Architect review of test application.

B. Sealer shall be applied by manufacturer-approved applicators using recommended methods and equipment. Do not exceed the application rate recommended by the manufacturer.
C. Do not dilute concrete densifier and chemical hardener.
D. Fresh Concrete
   1. Apply undiluted concrete densifier and chemical hardener as soon as concrete is firm enough to work on after final troweling.
   2. Apply undiluted concrete densifier and chemical hardener at approximately 650 - 800 ft.2/gal. using a low-pressure sprayer.
   3. Do not allow material to puddle on the surface.

3.4 FIELD QUALITY CONTROL

A. The Owner may employ a testing agency to test the in-place sealer in compliance with standards specified.
B. The Owner will pay cost of test, except when test discloses that the sealer tested does not comply with these Specifications; the Contractor shall pay subsequent retests until application meets Specifications requirements.
C. In the event test shows that the sealer is deficient, apply additional sealer.
D. Repetition of the above procedure on all previously treated surfaces will be at Contractor's expense.

3.5 CLEANING

A. Clean sealer from adjacent surfaces immediately after spillage.
B. Comply with manufacturer’s recommendations for cleaning.

END OF SECTION

SECTION 03 54 16 - SELF-LEVELING CEMENTITIOUS UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-leveling cementitious underlayment where monolithic concrete floor slabs to be covered by a finish material do not comply with the tolerances specified either in Section 03 30 00 or the Sections where the floor finishes are specified.
B. Related Requirements: Division 03 for structural concrete.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data for product proposed for use.
B. Tests: Test results as specified below.

1.3 QUALITY ASSURANCE

A. Installer qualifications: Licensed and approved in writing by the underlayment manufacturer.
B. Sample panel:

1. Provide, on a floor slab at the job site, a 10-foot square Sample panel of the cementitious underlayment to demonstrate texture of finish surface and test levelness of finish assembly.
2. Make such modifications as necessary to achieve a Sample panel satisfactory to the Architect or remove and construct additional Sample panel(s).
3. Approved Sample panel may remain in place shall serve as the standard for the same work on the building.

1.4 HANDLING

A. Deliver materials in their unopened packages and protect them from extreme temperatures and moisture.

1.5 JOB CONDITIONS

A. Do not place underlayment when the floor is covered with standing water or if surface temperature is 50 degrees or below.
B. Follow these Specifications and the self-leveling underlayment manufacturer's instructions for placing, finishing, curing and protecting self-leveling underlayment when the conditions require hot weather installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER/MATERIALS

A. Ardex, Inc., Ardex K-15” (basis of design.)
B. Atlas Tech Products “Tech-Level Premier.”
C. Mapei “UltraPLan 1.”
D. Dayton “Levelayer 1.”
E. Tec Specialties “Level Set 300.”
F. Or equal.

2.2 MATERIALS

A. Cementitious material: Ardex K-15, with total binder of 80 percent cement binder per ASTM C 114.
B. Aggregate: Well-grade, washed gravel for use when underlayment is installed thicker than 1-1/2 inch.
C. Water: Fresh, potable and not warmer than 70 degrees F.
D. Primer: Ardex P-51.
E. Feather edge skim finish: Ardex “Feather Finish.”

2.3 MIX DESIGN

A. As recommended by the underlayment manufacturer’s instructions to obtain a homogenous concrete mass that will flow freely, self-level and screed to a smooth, even surface within the tolerance specified, and shall meet the following:

1. Minimum compressive strength: 4,000 psi at 28-day when tested in accordance with ASTM C 109 MOD.
2. Minimum flexural strength: 1,000 psi at 20-day when tested in accordance with ASTM C 348.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Verify conditions affecting the work of this Section at the site.
B. Correct detrimental conditions before proceeding with installation.
C. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

D. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.

E. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

1. Install underlayment reinforcement recommended in writing by manufacturer.

3.2 PLACEMENT

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Prime subfloor leaving no bare spots.

C. Install screeds as recommended by manufacturer and as required to meet tolerance specified below. Set screeds with a laser level.

1. Set screeds so that the minimum thickness of underlayment will be at least 1/8 inch.
2. Where underlayment covers only a small area, grind, chisel and undercut slab, if required, so that the minimum thickness will not be less than 1/8 inch.

D. Place the underlayment in accordance with its manufacturer's instructions in one continuous operation without cold joints. Screed to required level suitable to receive finish flooring materials.

E. Finish underlayment so that it contacts a 10-foot straightedge with a tolerance not exceeding the following at any location:

1. One-sixteen inch under wood flooring.
2. One-eight inch elsewhere.

3.3 PROTECTING/PATCHING

A. Do not permit traffic on the underlayment until it has developed sufficient strength to withstand traffic without damage (minimum of 24 hours).

B. Patch damaged surfaces flush with adjacent areas in accordance with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. The Contractor shall have 2-inch cubes tested by a reputable and recognized testing laboratory, in accordance with ASTM C 109 MOD., to determine compliance with compressive strength specified.

END OF SECTION

DIVISION 04
MASONRY

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Reinforcing steel.
3. Mortar, grout and grouting.
4. Bolts, anchors, hardware, metal frames, and other insert items.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 10 00 - Concrete Forming and Accessories.
3. Section 03 20 00 - Concrete Reinforcing.
4. Section 03 30 00 - Cast-In-Place Concrete.
5. Section 05 10 00 - Structural Steel Framing.
6. Section 08 11 13 - Hollow Metal Doors and Frames.

1.2 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
2. ASTM C90 - Standard Specification for Load Bearing Concrete Masonry Units.
3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
4. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
8. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

9. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

10. ASTM C426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.

11. ASTM C476 - Standard Specification for Grout for Masonry.

12. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

13. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.

14. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

15. ASTM C1586 – Standard Guide for Quality Assurance of Mortars.

B. Masonry Standards Joint Committee (MSJC), the Masonry Society (TMS), American Concrete Institute (ACI) and American Society of Civil Engineers (ASCE).

1. TMS 602/ACI 530.1/ASCE 6 – Specification for Masonry Structures.

2. TMS 402/ACI 530/ASCE 5 – Building Code Requirements for Masonry Structures.

1.3 SUBMITTALS

A. Mix Design: Submit grout and mortar mix designs. Mix designs shall be signed and sealed by a Civil or Structural Engineer registered in the State of California.

B. Product Data: Submit manufacturer's Product Data for assembly components, materials, and accessories. Submit certificates and data assuring that the proposed materials meet the specified ASTM standards.

C. Samples: Submit Samples for each type of required masonry unit, including reinforcement and accessories.

D. Shop Drawings: Indicate wall reinforcement, splice locations and bending diagrams.

E. Admixtures: Additives and admixtures to mortar and grout shall not be used unless approved by the enforcing agency. Submit product data for any proposed admixture.

1.4 REGULATORY REQUIREMENTS

A. Perform the Work in accordance with CBC, Chapter 21A.

B. Comply with requirements of TMS 602.

1.5 QUALITY ASSURANCE

A. Comply with the requirements of Section 01 45 23 - Testing and Inspection.

B. Concrete Masonry Units:

1. Notify the testing laboratory a minimum of 45 days in advance of installing concrete unit masonry, to allow for preconstruction testing of the units.

    a. Units will be sampled and tested in accordance with ASTM C140 for compressive strength, absorption and moisture content.

    b. Units will be sampled and tested in accordance with ASTM C426 for linear drying shrinkage.

2. The material testing laboratory shall receive concrete masonry unit specimens for testing from masonry unit manufacturer. Number of specimens shall be as indicated in referenced ASTM standard tests. Testing laboratory will perform and send test results to the ARCHITECT and Project Inspector.

C. Portland Cement: Submit certification from the cement manufacturer that the cement proposed for use on the project has been manufactured in accordance with ASTM C150. Certification shall include test results made on cement samples during production.

D. Mortar and Grout Tests: Prior to the beginning of masonry work, mortar and grout will be tested, unless prism tests will be performed as indicated below.

1. Mortar: Shall conform to ASTM C270 Table 2 for Type S mortar.

    a. Provide qualifications of mortar as meeting ASTM C270 at the beginning of the job and whenever mix design is changed.

    b. Mortars will be evaluated during preconstruction and tested during construction for proportioning or compressive strength in accordance to ASTM C780.

2. Grout: Shall conform to ASTM C476, and will be tested in accordance with ASTM C1019. Compressive strength shall equal or exceed specified compressive strength (*f'm*) at 28 days, but not less than 2,000 psi.

    a. Ready-Mix Grout: Grout manufacturer shall furnish batch ticket information in accordance to ASTM C94.

E. Prism Test: The compressive strength of concrete masonry will be determined by the prism test method prior to the start of construction and during construction.

F. Masonry Core Testing: Core testing will be performed in accordance with CBC, Section 2105A.4.

G. Inspection During Installation: A special inspector will continuously observe the installation of reinforced masonry. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

H. OWNER will be responsible for the costs of original tests and inspection.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store units above grade on level platforms or pallets, in a dry location.

B. Store cementitious materials and aggregates in such a manner as to prevent deterioration or intrusion of foreign matter or moisture.

C. Handle units on pallets or flat bed barrows. Free discharge from conveyor units or transportation in mortar trays is not permitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Basis of Design: Angelus Precision Block.

B. Or equal.

2.1 MATERIALS

A. Concrete Unit Masonry: Modular **medium** weight conforming to ASTM C90, hollow load-bearing concrete unit masonry. Masonry units shall meet the minimum compressive strength requirements of ASTM C90, or as indicated on project drawings, whichever is greater.

1. Concrete masonry unit sizes: 8-inches by 10-inches, as indicated on the drawings.

2. Provide open-end units at walls to be fully grouted.

3. Provide closed-end units at walls and at openings where ends will be exposed in finish Work; provide bond beam blocks where horizontal reinforcement is indicated.

4. Provide special shapes and accessory units at locations indicated on Drawings.

5. Provide units in colors and textures as indicated in the drawings.

6. Masonry unit shall have been cured for a minimum of 28 days.

7. Masonry unit shall have maximum liner shrinkage of 0.065 percent from saturated to oven dry.

B. Portland Cement: ASTM C150, Type II, from one source.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates: ASTM C144 for mortar and ASTM C404 for grout.

E. Mortar: ASTM C270, Type S, conforming to the property specifications of CBC Table 2103A.8 (2).

F. Grout: ASTM C476.

1. Color: Gray by Specmix.

2. Or equal.

G. Admixture for Grout: Grout Aid, as manufactured by Sika Chemical Corp., or equal.

H. Water: Clean, potable, free from substances deleterious to mortar, grout or reinforcement.

I. Reinforcing Steel: Provide and install reinforcing steel in accordance with Section 03 2000 - Concrete Reinforcing.

J. Cleaning Materials: Sure Klean No. 600 detergent by ProSoCo.

K. Miscellaneous Materials: As required to complete the Work.

L. Anchor Bolts: Shall be hex headed bolts conforming to ASTM A307 Grade A with the dimensions of the hex head conforming to ANSI/ASME B18.2.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Discard units with cracks or other defects not complying with requirements of ASTM C 90.

3.2 CONSTRUCTION

A. Construct per applicable provisions of CBC and TMS 602.

B. Conform to TMS 602 for hot and cold weather masonry construction.

3.3 MORTAR AND GROUT MIXING

A. Mortar: Shall provide a minimum strength of 1,800 psi.

B. Grout: Shall provide a minimum strength of 2,000 psi or as indicated in the drawings, whichever is higher. Grout space requirements for coarse and fine grouts shall be per Table 7 of TMS 602. Add Sika Chemical Corp. Grout Aid per manufacturer's instructions.

C. Measurements: Measure in calibrated devices that can be checked at any time.

1. Add water for workable consistency.

2. Shovel measurements are not permitted.

D. Mixing: Mix in accordance to TMS 602.

1. Mortar: Mix cementitious materials and aggregates between three and five minutes in a mechanically operated mixer. Mix dry ingredients with a sufficient amount of water to provide a workable mix. Batches of less than one sack of cement, and fractional sack batches are not permitted.

2. Factory Blended Mortar: Mix in accordance with manufacturer's recommendations.

3. Grout: Add sufficient water for a workable mix that will flow into all voids of the masonry without separation or segregation. Grout slump shall be between 8 and 11 inches.

E. Re-tempering Time Limit: Use mortar within 2 ½ hours after mixing. Discard any mortar that has been mixed longer or that has begun to set. If necessary re-temper within this time limit, by replacing only water lost due to evaporation and by thoroughly remixing.

3.4 INSTALLATION OF MASONRY UNITS

A. Workmanship: Install masonry plumb and true to line with straight level joints of uniform thickness. Comply with TMS 602 tolerances. Maintain masonry clean during and after installation.

1. Lay-out and incorporate embedded hardware items.

2. Assist other trades with built-in items, which require cutting and fitting of masonry.

3. Cut block units with a diamond saw or carborundum wheel. Trowel or chisel cutting is not permitted.

4. Keep cavities clear of droppings and debris. Remove droppings prior to grouting.

B. Reinforcing Steel: Install as indicated on Drawings. Except as otherwise indicated, install reinforcement in accordance with standards of Concrete Reinforcing Steel Institute and to requirements specified in Section 03 2000 - Concrete Reinforcing. Do not splice vertical reinforcement except where indicated on the Drawings.

C. Shoring: Provide temporary shoring for lintels with sufficient strength to carry load without deflecting. Remove temporary shoring not less than 28 days after masonry has been installed.

D. Block Installation: Clean dirt and dust from surfaces before installation. Do not wet masonry units.

1. Foundation preparation: Clean top surface of concrete foundation of dirt, projections and laitance before starting masonry construction. Wet saw cutting of units immediately prior to laying is permitted.

2. Install masonry with mortar to required joint thickness. Install blocks with 3/8-inch mortar bed. Fill head joints solid, install tightly to adjoining units. Provide 3/8-inch joint thickness.

a. Hold racking to a minimum.

b. No toothing is permitted.

c. If it becomes necessary to move a unit after it has been installed, remove the unit, discard the mortar, and install the unit in fresh mortar.

3. Anchor Bolts: Provide 1/2-inch minimum grout space between bolts and masonry.

4. Bond: Unless otherwise indicated, install units in common running bond.

5. Finish Joint Treatment: Unless otherwise indicated, cut both interior and exterior joints flush, and tool slightly concave to a dense, uniform surface.

6. Grouting: Unless noted otherwise on Drawings, completely fill cells with grout.

E. Laying Masonry Walls: Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in a stack bond pattern is indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

F. Steel Door Frames:

1. Locate door frames accurately, install plumb, Set frames to floor with powder driven or expansion anchors to floor surface and brace in position before start of masonry installation.

a. Frames are specified to be furnished with adjustable anchors.

b. Fill interior of frames solid with mortar or grout as walls are constructed.

2. Provide temporary wood spreaders from jamb to jamb and from head to floor to ensure that jambs do not bow-in, distort from a straight line, or deflect from superimposed loads during construction.

3.5 GROUTING

A. Prior to grouting all cells shall be cleaned so that all spaces to be filled with grout do not contain mortar projections greater than 1/4 inch, loose mortar or foreign material.

B. Grout materials and water contents shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly. Reinforcement shall be properly positioned and solidly embedded in the grout.

C. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

D. Between grout pours, a horizontal control joint shall be formed by stopping all wythes at the same elevation and with the grout stopping at 1 ½ inches below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of ½ inch below the top of the masonry.

3.6 LOW-LIFT GROUTING FOR HOLLOW MASONRY UNITS

A. Grouting shall meet the requirements of CBC Section 2104A.1.3.

B. After mortar joints have set, cells are cleaned of mortar and debris, and reinforcement is installed and inspected, grout cells in 4-foot maximum lifts. Horizontal and vertical reinforcement shall be held in place within permitted tolerances by suitable devices.

C. Grout may be installed by pump, tremie or bucket, using hoppers to avoid spilling on exposed surfaces.

D. All grout shall be consolidated and reconsolidated with a mechanical vibrator after placing so as to completely fill all voids and to consolidate the grout. Grouted walls shall be solid and without voids.

3.7 HIGH-LIFT GROUTING OPTION FOR HOLLOW MASONRY UNITS

A. Grouting shall meet the requirements of CBC Section 2104A.1.3 and DSA IR 21-2.

B. High-lift grouting shall apply only to cell sizes available with 8 inch and wider block units. This method is subject to approval of the Division of the State Architect (DSA).

C. Provide bond beam units, inverted for start course, and omit alternate blocks or remove entire face shell of every other unit to allow access to all cells on bottom course for cleanouts.

D. Plug each cleanout by setting a face shell in mortar into opening and securely bracing it in place to prevent displacement. If masonry is not exposed in finish Work, cleanouts may be formed.

E. Grouting: Grouting shall be done in a continuous pour in lifts not exceeding 5-foot in height. The grouting of any section of a wall between control barriers shall be completed in one day, with no interruptions greater than one hour.

F. Consolidating: Grout shall be consolidated by mechanical vibration only, and shall be reconsolidated after excess moisture has been absorbed, but before plasticity is lost. Vibrating of reinforcing steel is not permitted.

3.8 CURING

A. Remove efflorescence, stains, debris, excess grout, and foreign matter.

B. During curing, or for any other purpose, do not saturate masonry with water.

3.9 PARGE COAT

A. Apply parge coat to the earth side of surfaces that are to receive waterproofing.

B. A Portland cement and sand mix (1:3.5 by volume) or Type S mortar may be used for the parge coat.

C. Parging should be applied to damp (not saturated) concrete masonry in two 1/4 inch thick layers. The first coat should be roughened when partially set, hardened for 24 hours, and then moistened before second coat is applied. The second coat should be trowelled to a smooth, dense surface.

D. The parge coat should be beveled at the top to form a wash, and thickened at the bottom to form a cove between the base of the wall and the top of footing.

3.10 CLEANING

A. At completion of masonry Work, remove misplaced mortar, grout or other foreign substances, and clean surfaces which will be exposed in finish Work with specified cleaner, or with clean water and stiff fiber brushes.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

DIVISION 05
METALS

SECTION 05 05 12 - HOT DIP GALVANIZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Surface preparation and zinc galvanic coatings applied in the shop or factory to surfaces of iron and steel installed at exterior locations and either totally or partially exposed to weather, humidity, moisture or precipitation; and elsewhere as indicated.
2. Repair of damaged galvanic coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation meeting:

1. Arrange for a preinstallation meeting between the Contractor, Architect, fabricator and galvanizer, to be held at least 2 weeks prior to the start of surface preparation and galvanizing to review galvanizing methods and processes.
2. Review Project schedule, scope of work indicated to be galvanized, coordination between fabricator and galvanizer, scheduled finish, application of coatings, submittals and approvals.
3. Review fabricator’s Shop Drawings to verify steel chemical composition suitability to receive zinc coating and to evaluate whether proposed fabrication methods will result in components and accessories that are suitable for galvanizing. Identify conditions that would be unsuitable for galvanizing, or that would require special processing techniques, and coordinate required fabrication modifications.
4. Review procedures to be followed in order to provide proper protection and touchup of zinc coatings during and after installation of components and accessories. Determine and reach agreement on the maximum aggregate galvanized coating area and maximum local damage size permitted to be repaired, whether in the shop or field, in compliance with the renovation guidelines of ASTM A 123.
5. Identify potential concerns during the galvanizing process, including handling issues that may require design modification before galvanizing proceeds.
6. Record minutes of the meeting, decisions made and corrective measures to be taken before galvanizing starts. Send copy of the minutes to the Architect no later than 3 days following the meeting.

1.3 SUBMITTALS

A. Submittals:

1. Shop Drawings: Submit galvanizing schedule indicating material category, material thickness and minimum coating grade mil thickness for each item to be galvanized.
2. Samples: Submit three 12-inch square Samples for flat work, and three 12-inch long Samples for each type of linear work, showing full range of spangle variation and general appearance to be expected in the Work.

3. Certificates: Upon completion of the Work, submit certificate signed by the galvanizer stating that coated items have been hot dip galvanized in compliance with the specified requirements.

    a. Indicate ASTM standard used for the hot dip galvanized coating, and certify coating meets or exceeds that ASTM standard's minimum requirements.
    b. Provide detailed description of the material processed and of quenching, if any.

1.4 QUALITY ASSURANCE

A. Galvanizer's qualifications: Firm and individuals with a minimum of 5 consecutive years' experience in the preparation of surfaces and the application of hot dip galvanized coatings for projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
B. Follow the procedures in the Quality Assurance Manual of the American Galvanizers Association
C. Coordination Between Fabricator and Galvanizer: Prior to fabrication, fabricators shall submit approved fabrication shop drawings to the galvanizer. The Galvanizer shall review fabricator'' shop drawings for suitability of materials for galvanizing and coatings and coordinate any required fabrication modifications.

1.5 HANDLING

A. Handle all articles to be galvanized to avoid mechanical damage.
B. Storage:

    1. Load and store galvanized products to prevent formation of wet storage film.
    2. Wet storage stain:

        a. When galvanized articles are packed loosely together for periods of time, take adequate precautions against wet storage stain. Minimize wet storage stains by maintaining a low humidity environment around the material and by providing adequate ventilation between stacked pieces.
        b. If outdoor stacking is unavoidable, raise the articles from the ground and separate with strip spacers to provide air circulation to all surfaces of the galvanized piece.
        c. Incline to provide maximum drainage.
        d. Do not leave uncovered material standing where it may be exposed to rain, mist, condensation, and frost.

C. If galvanized components must be stacked or stored in humid environments, apply an after-galvanized treatment to inhibit wet storage stain.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Zinc: ASTM B 6, Prime Western (PW) Grade.

B. Bath composition: ASTM 123.

2.2 ACCESSORIES

A. Galvanizing repair solder:

1. Description: Lead-free high zinc content solder formulated specifically for repairs to galvanized steel surfaces.
2. Products: Provide one of the following.

a. “All-State Galvover” by ESAB.
b. “Galvanizing Solder” by Belmont Metals.
c. “Galvanite” by Kapp Alloy & Wire, Inc.
d. “Zaclon Alloy Repair Rod” by Zaclon, Inc.

B. Galvanizing repair paint: “94-H20 Hydro-Zinc” by Tnemec Co., or equal by Valspar Corp., Devoe Coatings, ZRC Worldwide, or Ameron Protective Coating Division.

2.3 FABRICATION

A. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures.
B. Fabrication practices for products to be in accordance with the applicable portions of ASTM A 143, A 384, and A 385, except as specified herein. Avoid fabrication techniques that could cause steel distortion or embrittlement.
C. Fabricator shall consult with architect/engineer and hot-dip galvanizer regarding potential concerns, including handling issues, during the galvanizing process that may require design modification before fabrication proceeds.
D. Remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
E. Provide holes and/or lifting lugs to allow for handling during galvanizing.
F. Place vent holes where they will drain by gravity in the finished assembly. Plug vent holes with lead or silicone sealant after galvanizing.
G. Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint and other deleterious material prior to fabrication.
H. Remove by blast-cleaning, or other methods, surface contaminants and coatings that are not removable by the normal chemical cleaning process in the galvanizing operation.

2.4 FINISHES

A. Appearance: Bright minimized spangle zinc (galvanized) finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions affecting the work of this Section.
B. Consult with Architect and fabricator regarding potential concerns during the galvanizing process, including handling issues that may require design modification before galvanizing proceeds.
C. Correct detrimental conditions before proceeding with installation.
D. Reject excessively pitted and rusted components.

3.2 SURFACE PREPARATION

A. Remove oil, organic materials, mill primers, paint, crayon marks, grease or oil-based marks, and similar materials from metal before galvanizing. When directly identifying an item to be galvanized, provide an identification tag (preferred), or mark component on a surface that will be concealed in the Work, by stamping or with a seep stencil.
B. Pre-clean iron or steel with an alkaline cleaner, then acid pickle and flux; or blast-clean and flux (recommended method of processing high strength steels for galvanizing to avoid hydrogen embrittlement). The flux treatment must be a separate bath (dry kettle galvanizing).
C. Follow procedures outlined in ASTM A 1430 to safeguard against and test for possible embrittlement.

3.3 GALVANIZING

A. Comply with the American Galvanizing Association publication “The Design of Products to be Hot Dip Galvanized After fabrication,” and the following.
B. Coating application:

1. Galvanize non-fabricated materials, fabricated components and assembled steel items in compliance with ASTM A 123.
2. Galvanize castings and hardware items including bolts, nuts, washers and similar threaded fasteners, in compliance with ASTM A 153.
3. Safeguard products against steel embrittlement in conformance with ASTM A 143.
4. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

C. Coating thickness: Produce galvanized items having continuous, reasonably smooth and uniformly thick zinc coating.

1. Comply with the requirements of ASTM A 123 Table 2 for minimum coating thickness grade, as determined by material category and material thickness indicated in Table 1.
2. When galvanizing assemblies of components of varying material category and material thickness, provide minimum coating thickness grade for all members equal to or exceeding the maximum highest material category coating grade.
3. Allow for thickness of coating in threaded items.
4. Excessive dross, rough surfaces, blisters, lumpiness, runs, edge tears and spikes are not acceptable.

D. Use caution to avoid warpage and distortion in the galvanized assemblies:

1. Assemblies constructed of sheets or plates from 20-gage to 1/4-inch thick assembled by welding or riveting to bar-size shapes, angles. Channels, Tees, etc., commonly distort and warp and shall not be provided for the Project.
2. Warpage is accentuated by use of nonsymmetrical sections such as channels. Channels require straightening after galvanizing. Avoid using channels and other nonsymmetrical sections for the framework of a sheet metal assembly to be hot-dip galvanized where symmetrical shapes or sections can be used.
3. The use of wide radii bends in corners is recommended for sheet metal work.
4. Avoid unequal thickness of metal wherever possible due to the different rates of heating and cooling during the galvanizing operation and the effect of unequal expansion and contraction.
5. Continuously weld joints using balanced welding techniques to reduce uneven thermal stresses.
6. Provide temporary bracing and/or reinforcing to minimize or prevent warpage and distortion during galvanizing.
7. Seal welds to prevent moisture penetration in the welded joint.

E. Coating Appearance: Provide minimized spangled zinc coating. Coated surface for components such as handrails shall be smooth and without pits, craters, dross and other imperfections.

3.4 QUENCHING

A. Items scheduled to receive paint or coating:

1. Do not water-quench galvanized items scheduled to be painted immediately after galvanizing.
2. Do not chromate-quench galvanized items scheduled to be painted.
3. Do not phosphate-quench galvanized items scheduled to receive zinc-rich paint.

B. Items scheduled to remain uncoated: If required to prevent wet storage staining, quench freshly galvanized steel in a passivating solution.

3.5 REPAIR/RESTORATION

A. Repair areas damaged by welding, flame cutting or during handling, transport or erection by one of the approved methods in accordance with ASTM A 780 whenever damage exceeds 3/16-inch in width. Minimum thickness requirements for the repair are those described in ASTM A 123, Section 6.2.
B. Exposed-in-service galvanized surfaces scheduled to remain unfinished: Apply galvanizing repair solder in compliance with method specified in ASTM A 780, Annex A1.
C. Both concealed-in-service galvanized surfaces scheduled to remain unfinished and exposed galvanized surfaces scheduled to receive a field-applied coating: Apply galvanizing repair paint in compliance with method specified in ASTM A 780, Annex A2, to a minimum DFT of 8 mils, and overlapping undamaged area at least 2 inches.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspection: Perform inspection and testing of zinc coatings under the guidelines outlined in the American Galvanizer's Association (AGA) publication "Inspection of Products Hot Dip Galvanized After Fabrication."

1. Take thickness measurements with either a magnetic, electromagnetic, or eddy-current gage to ensure the applied zinc coating is as specified.
2. Determine whether zinc coating thickness on metal surfaces conforms to the minimum specified levels.
3. Re-coat non-conforming work.

3.7 PROTECTION

A. When galvanized items will be packed loosely together for periods of time, take adequate precautions to prevent wet storage stain by providing adequate ventilation between stacked items and by maintaining a low-humidity environment around galvanized material.
B. If outdoor stacking is unavoidable, store galvanized items off the ground and provide strip spacers in order to separate items and to provide air circulation around all surfaces of galvanized items.

1. Incline galvanized items to provide maximum drainage.
2. Do not leave galvanized items uncovered where they may be exposed to rain, mist, high humidity, condensation, or frost.

END OF SECTION

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Architecturally exposed structural steel.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 3000 - Cast-In-Place Concrete.
3. Section 04 2200 - Concrete Unit Masonry.
4. Section 05 0513 – Hot-Dip Galvanizing.
5. Section 05 1000 – Metal Stairs and Railings.
6. Section 05 3000 - Metal Decking.
7. Section 05 5000 - Metal Fabrications.
8. Section 09 9000 - Paints and Coatings.

1.2 REFERENCES

A. CBC Chapter 22A.

B. American Institute of Steel Construction (AISC):

1. AISC – Steel Construction Manual:
   a. AISC 360 Specifications for Structural Steel Buildings.
   b. AISC Code of Standard Practice for Steel Buildings and Bridges.
   c. RCSC Specification for Structural Joints Using High Strength Bolts.
2. AISC 341 - Seismic Provisions for Structural Steel Buildings.
3. AISC 358 - Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.

C. ASTM International (ASTM):

1. ASTM A36 – Standard Specification for Carbon Structural Steel.
2. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
4. ASTM A123 – Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60000 PSI Tensile Strength.
7. ASTM A435 - Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates.
8. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
9. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
10. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
12. ASTM A673 - Standard Specification for Sampling Procedure for Impact Testing of Structural Steel.
13. ASTM A992 – Standard Specification for Structural Steel Shapes.
14. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
15. ASTM E23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
16. ASTM E112 - Standard Test Methods for Determining Average Grain Size.
17. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
18. ASTM F436 – Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
19. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
20. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-Ksi Yield Strength.
21. ASTM F1852 – Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

D. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code - Steel.
2. AWS D1.8 – Structural Welding Code – Seismic Supplement.
3. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
4. AWS B2.1 – Base Metal Grouping for Welding Procedure and Performance Qualification.

E. SSPC – Steel Structures Painting Council:

1. SSPC-SP2 - Hand Tool Cleaning.
2. SSPC-PA-1 - Shop, Field and Maintenance Coating of Metals.

1.3 REGULATORY REQUIREMENTS

A. Structural steel shall conform to CBC requirements, except that steel manufactured by acid Bessemer process is not permitted for structural purposes.

B. Sheet and strip steel other than those listed in CBC, if provided for structural purpose, shall comply with DSA requirements.

1.4 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection. Fully detail minor connections and fastenings not shown or specified in the Contract Documents to meet required conditions using similar detailing as shown in the Contract Documents. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion; submit sequence and technique plan for review by the ARCHITECT.

1. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1 or AISC Chapter J, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.

2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other sections.

3. Erection and Bracing Plan and Erection Procedure: Submit an erection and framing plan, including columns, beams, and girders, signed and sealed by a Structural or Civil Engineer registered in the State of California in accordance with Title 8 California Code of Regulations, Section 1710, Structural Steel Erection. Maintain a copy at the Project site as required by the California Division of Industrial Safety.

4. Submit a list of steel items to be galvanized.

5. Include identification and details of Architecturally Exposed Structural Steel (AESS) members, if applicable.

B. Product Data: Submit copies of fabricator’s specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:

1. Structural steel, each type; including certified copies of mill reports covering chemical and physical properties.

2. Welding electrodes.

3. Welding gas.

4. Unfinished bolts and nuts.

5. Structural steel primer paint.

6. High-strength bolts, including nuts and washers.

C. Manufacturer’s Mill Certificate: Submit, certifying that products meet or exceed specified requirements.

D. Mill Test Reports: Submit manufacturer’s certificates, indicating structural yield and tensile strength, destructive and non-destructive test analysis.

E. Charpy-V-Notch (CVN) Impact Test: Submit certified copies of Charpy-V-Notch (CVN) Impact Test by the manufacturer for applicable steel members and components.

1. Charpy-V-Notch (CVN) Impact Test for Base Metal: Moment frame columns and girders subjected to Charpy-V-Notch impact test in accordance with "Seismic Provisions for Structural Steel Buildings", Part I, Section 6.3, as modified by Supplement 1.

2. Charpy-V-Notch test shall be performed by the manufacturer employing Test Frequency (P) in accordance with ASTM A673 and utilizing standard specimen sizes shown in Figure 6 of ASTM E23.

F. Submit certified copies of tests by manufacturer for fine grain practice. Structural steel base material, as described above, shall be manufactured to be fully killed and fine grained having grain size number 5 or better as determined by ASTM E112.

G. Welding Procedure Specifications (WPS): Submit weld procedures for all welding on project to OWNER's testing laboratory for approval. After approval by testing laboratory, submit to ARCHITECT for Record. Weld procedures shall be qualified as described in AWS D1.5, AISC 341 and AISC 358, as applicable. Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged; from these averages the weld heat input shall be calculated. Submit the manufacturer's product data sheet for all welding material used.

H. Welder's Certificates: Field welders shall be Project certified in accordance with AWS D1.1. Shop welders shall be Project certified for FCAW in accordance with AWS D1.1.

I. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections. Include data on type of test conducted and test results.

J. Welding Material Certification: Provide certificate that welding material complies with specifications. Submit to OWNER's testing laboratory.

1.5 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement, except as otherwise indicated:

1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges, modified as follows:

a. Replace "Structural Design Drawings" with "Contract Documents' throughout the document.

b. Paragraph 3.2 is hereby modified in its entirety as follows: "Contract Documents including but not limited to architectural, mechanical, plumbing, electrical, civil and kitchen design drawings and specifications shall be used as supplement to the structural plans to define configurations and construction information."

c. Delete Paragraph 3.3.

d. In Paragraph 4.4, delete the following sentence: "These drawings shall be returned to the Fabricator within 14 calendar days."

e. Delete Paragraph 4.4.1.(a) in its entirety.

f. Paragraph 4.4.2 is hereby modified in its entirety as follows: "No review action, implicit or explicit, shall be interpreted to authorize changes in the Contract Documents."

2. Perform welding in accordance with AWS Standards, AWS D1.1, and California Building Code Section 2204A.1 and approved Weld Procedure Specifications (WPS).

B. Shop fabrication shall be inspected in accordance with CBC.

C. Erect mock-up panel of fabricated structural steel meeting Architecturally Exposed Structural Steel (AESS) tolerances for exposed areas. Approval by ARCHITECT is required. Mock-up to remain for comparison but may not be left as part of the work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store structural steel above grade on platforms, skids or other supports.

B. Protect steel from corrosion.

C. Store welding electrodes in accordance with AWS D 12.1.

D. Store other materials in a weather-tight and dry place until installed into the Work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Stock Materials: Provide exact materials, sections, shapes, thickness, sizes, weights, and details of construction indicated on Drawings. Changes because of material stock or shop practices will be considered if net area of shape or section is not reduced thereby, if material and structural properties are at least equivalent, and if overall dimensions are not exceeded.

B. Shapes, bars, plates, tubes and pipes shall be made of materials with at least 16 percent recycled content if produced from Basic Oxygen Furnace (BOF) or at least 67 percent recycled content if produced from Electric Arc Furnace (EAF).

2.2 MATERIALS

A. Structural Steel: Wide flange shapes shall conform to ASTM A992 grade 50. Other steel shall conform to ASTM A36.

B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low carbon bolts and nuts.

C. High-Strength Threaded Fasteners: ASTM F3125 or ASTM F959 quenched and tempered, steel bolts, nuts and washers.

D. Primers: Lead-free metal primer:

1. SSPC-Paint 20, Zinc-Rich Coating Inorganic and Organic.

2. SSPC-Paint 23, Latex Primer for Steel Surfaces.

E. Steel Pipe: ASTM A53, Type E or S, Grade B.

F. Structural Tubing:

1. Hot-formed, ASTM A501.

2. Cold-formed, ASTM A500, Grade B.

G. Galvanizing: ASTM A123.

H. Welding Electrodes: Provide electrodes recommended by manufacturer for seismic connections. Comply with AISC 341.

I. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at seven days; of consistency suitable for application and a 30 minute working time.

2.3 FABRICATION

A. Fabricate in accordance to AISC Code of Standard Practice for Steel Buildings and Bridges and AISC 360.

B. Cleaning and Straightening Materials: Materials being fabricated shall be thoroughly cleaned of scale and rust, and straightened before fabrication. Cleaning and straightening methods shall not damage material. After punching or fabrication of component parts of a member, twists or bends shall be removed before parts are assembled.

C. Cutting, Punching, Drilling and Tapping: Unless otherwise indicated or specified, structural steel fabricator shall perform the cutting, punching, drilling and tapping of Work so that Work of other trades will properly connect to steel Work.

D. Milling: Compression joints depending on contact bearing shall be furnished with bearing surfaces prepared to a common plane by milling.

E. Use of Burning Torch: Oxygen cutting of members shall be performed by machine. Gouges greater than 3/16 inch that remain from cutting shall be removed by grinding. Reentrant corners shall be shaped notch free to a radius of at least 1/2 inch. Gas cutting of holes for bolts or rivets is not permitted.

F. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized per Section 05 5013, Hot-Dip Galvanizing.

G. Welding:

1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the verification and inspection requirements of CBC Chapter 17A. Conform to AWS D1.1, and CBC Chapter 22A.

2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:

   a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the ARCHITECT.

   b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.

3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.

4. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

5. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

H. Shop Finish:

1. Notify the Project Inspector when Work is ready to receive shop prime coat. Work shall be inspected by the Project Inspector before installation of primer.
2. Structural steel and fittings shall receive a coat of primer, except:
   a. Surfaces that will be galvanized.
   b. Surfaces that will be fireproofed.
   c. Surfaces that will be field welded.
   d. Surfaces in contact with concrete.
   e. Surfaces high strength bolted.
3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.

I. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

J. Fabricate Architecturally Exposed Structural Steel with exposed surfaces smooth, square, and free of surfaces blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.
2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for Architecturally Exposed Structural Steel.

K. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint when temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Grind smooth tack welds and holes filled with weld metal or body solder. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

2.4 SHOP AND FIELD QUALITY CONTROL

A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect high-strength bolted connections. OWNER will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with CBC 1704A. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

B. An AWS certified welding inspector (CWI), approved by DSA to inspect the Work of this section, shall inspect welded connections in accordance with CBC 1705A.2.5. The OWNER will provide a DSA approved independent testing laboratory to perform tests and prepare test reports. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations there from.

D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.

E. The independent testing laboratory may inspect or test structural steel at plant before shipment; however, ARCHITECT reserves the right at any time before Contract Completion to deem materials not in compliance with the specified requirements as defective Work.

F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.

G. Inspection of Structural Tube Steel/Hollow Structural Sections (HSS): Structural tube steel members (round, square, rectangular), disregarding steel origin, will be inspected during shop fabrication per DSA Bulletin 07-03. Inspector will perform a visual examination of the seam weld area for visible discontinuities. When defects are suspected, non-destructive testing will be considered.

H. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.

2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods. Testing shall be performed to AWS D1.1 Table 6.3 cyclically loaded non-tubular connections.

3. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Repair and test defective welds.

4. Rate of Testing: Completed welds contained in joints and splices shall be tested 100 percent either by ultrasonic testing or by radiography.

5. Welds, when installed in column splices, shall be tested by either ultrasonic testing or radiography.

6. Base metal thicker than 1 ½-inch, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.

7. Material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the ARCHITECT and DSA.

8. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.

9. Lamellar Tearing: Lamellar-tearing resulting from welding is a crack (with zero tolerance) and shall be repaired in accordance with AWS D1.1.

10. Lamination: The rejection criteria shall be based on ASTM A435.

11. Where testing reveals lamination or conditions of lamellar tearing in base metal, the steel fabricator shall submit a proposed method of repair for review by the ARCHITECT. Test repaired areas as required.

12. Magnetic Particle Testing: Magnetic particle testing when required shall be provided in accordance with AWS D1.1 for procedure and technique. The standards of acceptance shall be in accordance with AWS D1.1 – Qualification.

I. Lamellar Tearing: Prior to welding plates 1 to 1-½ inch thick and greater and rolled shapes within the distance from 6 inches above the top of the joint to 6 inches below the bottom of the joint shall be checked by ultrasonic testing for laminations in base metal which may interfere with the inspection of the completed joint. Should these defects occur, members will be reviewed by the ARCHITECT and DSA. Welding procedure specifications in paragraph 1.04.G specify welding practices to minimize lamellar tearing.

J. Prior Testing of Base Material: Test material before fabrication.

K. Lines and levels of erected steel shall be certified by a State of California licensed surveyor as set forth in related Division 01 section.

L. Welded studs shall be tested and inspected by the special inspector in accordance with requirements of AWS D1.1 – Stud Welding.

M. Record Drawings: After steel has been erected, correct or revise Shop Drawings and erection diagrams to correspond with reviewed changes performed in the field.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify governing dimensions and conditions of the Work before commencing erection Work.

1. Report discrepancies between drawings and field dimensions to ARCHITECT before commencing work.

2. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.

B. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

C. Coordinate prime coat repair and application with requirements of Section 09 9000.

3.2 ERECTION

A. Install structural steel accurately in locations, to elevations indicated, and according to AISC specifications and CBC requirements.

B. Clean surfaces of base plates and bearing plates.

1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.

C. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.

1. Architecturally Exposed Structural Steel members and components, plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. CONTRACTOR to provide adjustable connections between Architecturally Exposed Structural Steel and the structural steel frame or the masonry or concrete supports, in order to provide the erector with means for adjustment.

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that

will be in permanent contact after assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Do not permit thermal cutting during erection of structural steel.

F. Where indicated for field connections, provide standard bolts complying with ASTM A307.

G. Install high strength steel bolts at locations indicated. Assembly and installation shall be in accordance with CBC requirements and AISC specifications.

1. Allowable hole sizes: 1/16 inch larger than bolt size.

2. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.

3. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.

4. Tighten bolts by power torque wrench or hand wrench until twist-off.

H. CONTRACTOR shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.

I. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.

J. Install column bases within a tolerance of 1/8 inch of detailed centerlines, level at proper elevations. Support bases on double nuts and solidly fill spaces under bases with cement grout.

K. Provide anchor bolts with templates and diagrams. CONTRACTOR shall be responsible for proper location and installation of bolts. Correct deficiencies and errors.

3.3 FITTING

A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.

B. Drilling to enlarge unfair holes will not be allowed. Allow only enough drifting during assembly to bring parts into position, but not enough to enlarge holes or distort the metal. Do not heat rolled sections, unless approved by ARCHITECT.

3.4 PUNCHING AND DRILLING

A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.

B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.

C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming; flame cutting to enlarge holes is not acceptable. Structural Steel members with poorly matched holes will be rejected.

3.5 FINISHING

A. After erection, spots or surfaces where paint has been removed, damaged, or burned off, and field rivets, bolts, and other field connections shall be cleaned of dirt, oil, grease, and

burned paint and furnished with a spot coat of the same primer installed during shop priming.

B. Touchup:

1. Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

2. Galvanized Surfaces: Clean field welds, connections and damaged areas. Apply two coats of Carbomastic 15, by Carboline or equal product approved by OWNER's OEHS. Brush or roll to a 4 to 6 mil thickness.

3.6 FIELD QUALITY CONTROL

A. OWNER will provide a special inspector and independent testing laboratory to perform field inspections and tests and to prepare test reports.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.7 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project Site.

3.8 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.9 HANDLING

A. Both in shop and in the field, transport, handle and erect to prevent damage or overstressing of any component.

END OF SECTION

SECTION 05 41 00 - COLD-FORMED STEEL FRAMING *(NON-AXIAL LOAD BEARING WALLS)*

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior vertical cold-formed steel framing (CFSF) system consisting of non-axial, load bearing punched channel studs and Cee-shaped steel studs.

B. Related requirements:

1. Division 05 for structural steel.
2. Division 07 for thermal insulation in CFSF system.
3. Division 09 for non-structural metal framing, and ceiling and soffit suspension systems.

C. Definition: Design engineer as used in this Section refers to a California-licensed structural engineer engaged by the Contractor to perform the tasks specified below to comply with the “deferred approval “process.

1.2 ADMINISTRATIVE REQUIREMENTS

1.3 SUBMITTALS

A. Data: Manufacturer Product Data including specifications for the following.

1. Studs and runners.
2. Installation instructions for each item of cold-formed metal framing and accessories.
3. Mill certificates.
4. Galvanizing certificates.

B. Shop Drawings:

1. Large scale (minimum 1:32), dimensioned Shop Drawings of all assemblies.
2. Show elevations of each wall, framing member size and gage designations, number, type, location, and spacing.
3. Indicate connections/attachments, clips, strapping, bracing, splices, bridging, accessories, and details required for proper installation at 1:12 minimum scale.
4. Indicate and identify all fasteners and welds (with AWS symbols).
5. Indicate loads imposed on the primary building structure.

C. Load tables:

1. Complete load tables properly annotated for anticipated use for all studs.
2. Indicate conformance or deviation with design criteria indicated on the Structural Drawings.

D. Approval by DSA: As specified below. Submit reviewed Shop Drawings, calculations and other supporting data required by the DSA for their review and approval. Pay applicable fees resulting therefrom.

E. Preconstruction test reports: Indicate and interpret test results for compliance with requirements.

F. Product test reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products.

1. Steel sheet.

2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

G. Research/evaluation reports: For cold-formed metal framing.
H. Manufacturer installation instructions: For framing members and accessories.
I. Sealant compatibility and adhesion test reports: From sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants; include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed for adhesion.
J. Field test reports: Indicate and interpret test results for compliance with requirements.
K. Closeout: Furnish the Owner a comprehensive plan for replacement of broken glass. Include a local source.
L. Certificates:

1. Mill certificates signed by framing member/accessory manufacturer certifying compliance with material requirements.
2. Welder certificates signed by Contractor certifying that welders comply with specified requirements.

M. Qualification data: For design engineer and testing agency.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer: Firm with minimum 3 years' experience in installation of the type of products specified.
2. Testing agency: Independent testing agency, acceptable to DSA and qualified according to ASTM E 329 to conduct the testing indicated.

B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.
C. Product tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with specified requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."
E. Fire-rated assemblies: Where the work of this Section is a component of assemblies indicated to be fire-rated, including those required for compliance with governing regulations, provide units approved by DSA.
F. Mockup(s): Provide CFSF components for mockups specified elsewhere in these Specifications.

1.5 HANDLING

A. Protect metal framing units from rusting and damage.
B. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS.

A. Where stud sizes and connections are indicated on the Drawings, do not substitute with items of lesser structural capacity.

2.2 MANUFACTURERS

A. General: One of the following members of the MSMA or SSMA.
B. Studs:

1. CEMCO.
2. ClarkDietrich Building Systems.
3. Marino Industries, Inc.
4. SCAFCO Corp.
5. Superior Steel Studs, Inc.
6. Or equal.

C. Tracks: Bottom tracks by stud manufacturer; top track by one of the following.

1. ClarkDietrich Building Systems “Maxtrack 2D.”
2. CEMCO “Exterior Slotted Track.”
3. Or equal.

2.3 STEEL FRAMING COMPONENTS

A. Studs: Channel-shaped with lipped flanges, punched web, size (depth) indicated on Drawings, thickness and grade required by structural design calculations.
B. Tracks: Same designation, coating, and thickness as studs except as otherwise noted, channel-shaped, solid web, depth compatible with studs, size, thickness and grade required by structural design calculations.
C. Accessories: Manufacturer standard steel accessories, including but not limited to the following.

1. Supplementary framing.
2. Bracing, bridging, and solid backing.
3. Web stiffeners.
4. Gusset plates.
5. Stud kickers and girts.
6. Reinforcement plates.

D. Bridging:

1. Cold-rolled channel: 1-1/2 by 1/2-inch by 56-mil thick.
2. Bridging clip: BridgeClip by The Steel Network, Inc., or equal. Provide attachment through stud punch-out clamping onto stud web and wrapping around bridging channel. Provide holes for screw attachment to stud web and channel.
3. Flat strap: Width and thickness required by structural design calculations for rigid attachment to stud flange.
4. Solid bridging: Channel-shaped bridging with lipped flanges and integral formed clips, BridgeBar by the Steel Network, or equal, screw attachment to stud, 33-mil minimum thickness, size as required by structural design calculations.

2.4 MATERIALS

A. Steel - general: ASTM A 653 steel; SS Grade 50, Class 1 minimum tensile strength, unless otherwise indicated on the Drawings.
B. Finish on steel:

1. General: Provide framing components galvanized with a G 60 zinc coating; EQC is not acceptable.
2. Accessories: Finish to match that of main framing components.

C. Fasteners:

1. Screws: Corrosion-resistant coated, self-drilling, pan or hex washer head. Provide screw type and size required by structural design calculations.
2. Anchor bolts and studs: ASTM A 307, Grade A, carbon steel, with hex-head carbon steel nuts and flat steel washers. Hot-dip zinc coated in accordance with ASTM A 153. Provide bolt or stud type and size as required by structural design calculations.
3. Expansion anchors: FS FF-S-325, Group II, Type 4, Class 1. Provide bolts listed or approved by authorities having jurisdiction, and of diameter and length as required by structural design calculations.
4. Powder-actuated fasteners: FS FF-P-395 made from AISI 1062 or 1065 steel, austempered to a minimum core hardness of 50 to 54 HRC and zinc plated in accordance with ASTM B 633. Provide fasteners listed or approved by authorities having jurisdiction, of type, diameter and length required by structural design calculations:
5. Welding electrodes: Comply with AWS Code and as recommended by stud manufacturer.

D. Isolating tape: 1/4 inch thick by 1-1/2 inch wide by 8 feet long “Thermablok” tape by Thermablok, or equal consisting of self-adhering flexible aerogel and fiber composite insulation with a thermal conductivity of 0.0078Btu/ft/hr/F.
E. Galvanizing repair (zinc-rich) paint: “94-H20 Hydro-Zinc” by Tnemec Co., or equal by Valspar Corp., Devoe Coatings, ZRC Worldwide, or Ameron Protective Coating Division.

2.5 FABRICATION

A. General:

1. Framing components may be prefabricated into assemblies before erection. Design panels to resist handling as well as dead and live loads without damage and permanent deflection.
2. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.
3. Space studs no more than 1/8-inch from designated spacing.
4. Prefabricated panels shall be no more than 1/8-inch out-of-square within the panel length.
5. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Make all stud-to-track connections prior to handling the panel.
6. Lift prefabricated units to prevent damage and distortion.

B. Cutting: Cut members by shearing or sawing.
C. Fastenings:

1. Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer and accepted on the Shop Drawings.

2. Wire-tying and screw-attachment of framing components, unless otherwise indicated, is not permitted.

D. Fabrication tolerances: Fabricate CFSF assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1:960 and as follows.

1. Spacing:

a. Space individual framing members no more than plus or minus 1/8-inch from plan location.
b. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each CFSF assembly to a maximum out-of-square tolerance of 1/8-inch.

E. Damaged zinc coating: Touchup damaged galvanizing before shipment of assemblies to site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. General:

1. Install CFSF systems in compliance with the approved Shop Drawings, their manufacturer's instructions, ASTM C 1007, and these Specifications.
2. Field cutting is allowed with saws or shears, but not torch cutting. Restore damaged zinc coating as specified.
3. Reinforce holes cut thru the studs.

B. Runner tracks:

1. Install continuous tracks sized to match studs.
2. Align tracks accurately to layout at base and tops of studs. Secure tracks as accepted on Shop Drawings.
3. Fasten tracks securely to supports.

C. Studs:

1. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges, as accepted on Shop Drawings.
2. Install members in single piece lengths except that tracks may be spliced, butt-welded, or each length anchored to a common building frame element.
3. Set studs plumb within the tolerance specified, except as needed for diagonal bracing or required for out-of-plumb walls or warped surfaces and similar requirements.
4. Where stud system abuts structural columns or walls, anchor ends of stiffeners to supporting structure.
5. Where components are boxed to form closed tubes, fill these areas with insulation that would otherwise remain uninsulated after assembly of the framing members.

6. Install insulation in framing spaces of insulated assemblies made inaccessible after erection.

D. Supplementary framing:

1. Install supplementary framing, blocking, and bracing in metal framing system where walls are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall.
2. Comply with stud manufacturer recommendations and industry standards in each case, considering weight or loading resulting from item supported.

E. Frame wall openings larger than 2 feet square with double stud at each jamb of frame except where more than 2 studs are indicated.

1. Install runner tracks and jack studs above and below wall openings.
2. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall.
3. Secure stud system wall opening frame as indicated.

F. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

G. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 54 inches o.c.

H. Welding:

1. Perform welding in compliance with AWS recommendations by welders qualified to weld lightgage metal.
2. Provide stitch plates where studs are burned-through.

I. Isolating tape:

1. Clean contact surfaces of oil, grease and other foreign materials that would prevent adhesion of the isolating tape.
2. Remove protective paper and install tape on exterior face of studs and runners, so that there will be no direct contact between metal framing members and subsequently applied materials, such as sheathing. Butt ends tightly.

J. Erection tolerances:

1. Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.
2. Set exterior edge of studs within 1/8 inch in or out of the theoretical plane of the wall.
3. Maximum variation in plane and true position shall not exceed L/960 from plumb and level with individual framing members no more than plus or minus 1/8 inch from plan location.
4. Cumulative error shall not exceed minimum fastening requirements of sheathing and other finishing materials.

3.3 FIELD QUALITY CONTROL

A. The Owner may employ a qualified testing laboratory to perform the following tests and submit test reports.

B. Testing agency will review and approve Weld Procedure Specifications submitted by the Contractor. The testing agency shall visually observe welding procedures to certify the WPS plan is followed.

1. Perform visual inspection of a minimum of 20 percent of all welds.
2. Additional testing will be required for the following:

a. If more than 5 percent of the tested welds are rejected, than an additional 20 percent of all welds shall be tested. This additional testing process shall be repeated until the rejection rate drops below 5 in 100.
b. Costs of additional inspection required by this paragraph shall be borne by the Contractor.

C. Inspections and testing shall be in conformance with the CBC.

3.4 TOUCHUP

A. Touchup damaged shop-applied protective coating, including cut ends and welds.
B. Use zinc-rich galvanizing paint for prime-coated and galvanized surfaces. Sand or grind damaged zinc coating to bright metal and apply zinc-rich paint, to a minimum DFT of 2 mils, overlapping undamaged area at least 2 inches. Comply with ASTM A 780.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal fabrications not classified as "structural steel", and not specified in other Sections, including the following:

1. Miscellaneous framing and supports, including signage support framings.
2. Aluminum caged roof ladders.
3. Miscellaneous steel trim.
4. Metal bollards.
5. Cane detection rail.
6. Loose bearing and leveling plates.
7. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

B. Related requirements:

1. Division 03 for grouting and dry-packing other than required for the work of this Section.
2. Division 04 for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Divisions 05 and 09 for light-gage metal framing (studs, channels, etc.) for support of plaster and gypsum board, and backing plates for surface-applied items fastened to these materials.
4. Division 05 for the following:

    a. Architectural metal fabrications.

5. Division 09 for finish painting metal fabrications.

C. Work installed but furnished in Division 32: Gate hardware.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing: Schedule installation so wall attachments are made only to completed walls.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 SUBMITTALS

A. Data:

1. Specifications and installation instructions for manufactured items.
2. Manufacturer's literature, including engineering data for anchors and data sheets for gate hardware.

B. Shop Drawings:

1. Large scale, dimensioned Shop Drawings of metal fabrications indicating in detail methods of fabrication and assembly, weight, materials, holes, lugs, inserts, finishes and other pertinent data.

2. For components to be embedded in concrete and masonry work, furnish templates supplemented by dimensioned Shop Drawings to trades placing those components in their work. Assist in location of these components where so requested by those trades.
3. Provide reaction loads for stair hangers and brackets.

C. Samples: Provide 3 minimum 6-inch square samples of finished material for ladders.
D. Welding certificates.
E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
F. Research Reports: For post-installed anchors.

1.4 QUALITY ASSURANCE

A. Qualifications for welding work:

1. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
c. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

2. Examine that welders to be employed in this work have satisfactorily passed AWS qualification tests.
3. If recertification of welders is required, retesting shall be Contractor's responsibility.
4. Submit certificates of compliance to demonstrate compliance with the above requirement.
5. Costs for fabricator tests, inspections and quality control shall be borne by the Contractor.

B. Ladder Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.
4. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification for ladders: Product design shall comply with OSHA 1910.27 minimum standards for ladders.
D. Special inspections:

1. Except where otherwise specified, special inspections by Owner’s testing laboratory, prescribed by Code, will not be required where work is performed on the premises of a licensed fabricator, registered and approved by authorities having jurisdiction to perform such work without special inspection.
2. Submit certificates of compliance to demonstrate compliance with the above requirement.
3. Costs for fabricator tests, inspections and quality control shall be borne by Contractor.

1.5 HANDLING

A. Store metal fabrications above ground, under cover.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 LADDER WARRANTY

A. Provide an extended Warranty for ladders of this Section for a period of 5 years commencing with Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide load-bearing assemblies capable of safely withstanding the dead loads of the assemblies, plus the live loads prescribed by Code without exceeding allowable design working stress of materials involved, including anchors and connections. Apply each load to produce maximum stress in each component.

B. Thermal movements: Provide exterior assemblies with expansion joints spaced so that no distortion or damage occurs when subjected to a surface temperature of plus 180 degrees and a temperature swing of 160 degrees (plus 20 to plus 180 degrees).

1. Make joints as small as possible but sufficiently wide to meet the design criteria.
2. Show joint spacing on Shop Drawings.
3. Space joints equally and symmetrically. Joint locations are subject to relocation at no additional cost to the Owner.

2.2 MATERIALS

A. Metal surfaces - general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and absence of surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel plates, shapes, and bars: ASTM A 36.

C. Steel tubing:

1. Cold-formed steel tubing: ASTM A 500, Grade A or B, as required for design loading, unless otherwise indicated.
2. Hot-formed steel tubing: ASTM A 501. For exterior installations and where otherwise specified, provide tubing with hot-dip galvanized coating in compliance with ASTM A 53.

D. Steel pipe/tubing:

1. Handrails: One of the following.

a. Welded and Drawn Over Mandrel (DOM), ASTM A 513, Type S.
b. Cold Drawn Seamless (CDS), ASTM A 519.

c. Hot Finished Seamless (HFS), ASTM A 519, machined to match the finish of the DOM steel above.

2. Elsewhere: ASTM A 53; finish, type, and weight class as follows.

a. Galvanized finish for exterior installations and where specified, black finish elsewhere.
b. Type S, Grade A, standard weight (schedule 40), unless another grade or weight or both required by design loading.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Galvanized Steel: ASTM A653/A653M, commercial steel, Type B, with G90 (Z275) coating; 0.108-inch nominal thickness.
3. Cold-Rolled Steel: ASTM A1008/A1008M, commercial steel, Type B; 0.0966-inch minimum thickness;

a. Interior application: unfinished
b. Exterior application: hot-dip galvanized after fabrication.

F. Uncoated structural steel sheet: Product type (manufacturing method), quality, and grade, as follows.

1. Cold-rolled structural steel sheet: ASTM A 1008, Grade A, unless otherwise required by design loading.
2. Hot-rolled structural steel sheet: ASTM A 1011, Grade 30, unless otherwise required by design loading.

G. Uncoated steel sheet: Commercial quality, product type (method of manufacture) as follows.

1. Cold-rolled steel sheet: ASTM A 1008.
2. Rolled steel floor plate (Checkered): ASTM A 786, Pattern No. 1, 4 or 5. Use same pattern throughout the Project.
3. Hot-rolled steel sheet: ASTM A 1011.

H. Galvanized steel sheet:

1. Structural quality: ASTM A 653 SQ, Grade 33, G90 designation, unless another grade required for design loading.
2. Commercial quality: ASTM A 653 CQ, G90 coating designation.

I. Concrete inserts:

1. Threaded or wedge type galvanized ferrous castings, either malleable iron complying with ASTM A 47, or cast steel complying with ASTM A 276.
2. Provide bolts, washers, and shims as required, hot-dip galvanized in compliance with ASTM A 153.

J. Welding rods and bare electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

K. Fasteners: Provide zinc-coated fasteners for exterior use or where built into exterior walls, elsewhere fasteners may be uncoated. Select fasteners for type, grade, and class required.

1. Bolts and nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, Property Class 4.6; with hex nuts, ASTM A 563; and flat washers, unless otherwise indicated.
2. Anchor bolts: ASTM F 1554, Grade 36.
3. Machine screws: ASME B18.6.3, ASME B18.6.7M.
4. Plain washers: Round, carbon steel, ASME B18.22.1.
5. Lock washers: Helical, spring type, carbon steel, ASME B18.21.1.

6. Post -Installed Anchors: Torque-controlled expansion anchors.

   a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
   b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

7. Chemical anchors:

   a. Set by Simpson Strong-Tie Co., Inc., or HY-150 by Hilti, both used with machine bolts complying with FS FF-B-575, Grade S.
   b. Select drilled-in and chemical anchors to resist loads imposed thereon with a safety factor of 4 minimum for static loads, and 10 minimum for dynamic and overhead loads.

8. Lock washers: Helical spring type carbon steel, FS FF-W-84.

L. Grout: See Section 03 30 00.
M. Cement (expansive): Factory-prepared with accelerators quick-setting hydraulic cement complying with ASTM C 595.
N. Shop primer for ferrous metal:

1. Interior surfaces: Tnemec Unibond 115 or V-115 (basis of design), or equal fast-curing, lead-free, waterborne crosslinking hydrophobic acrylic primer selected for compatibility with finish paint systems specified in Section 09 90 00, and complying with performance requirements equal to or better than the basis of design.
2. Exterior surfaces: As specified in Section 09 96 00.

O. Galvanizing repair (zinc-rich) paint: “94-H20 Hydro-Zinc” by Tnemec Co., ZRC by ZRC Worldwide, Amercoat 68HS by PPG or equal.
P. Bituminous paint: Cold-applied asphalt mastic complying with SSPC Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.
Q. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
R. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
S. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
T. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ISO 3506-1); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in

concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ASTM F836M).

H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Interior metal shop primers: Provide primers that comply with Section 09 90 00 - Painting.
B. Exterior non-galvanized steel: Use rich-zinc primer compatible with topcoat..
C. High Performance Coatings: Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, and compatible with topcoat. Coordinate with Section 09 96 00.
D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 PREFABRICATED UNITS

A. Metal Bollards

1. Fabricate metal bollards from Schedule 40 steel pipe.
2. Cap bollards with 1/4-inch- thick steel plate.
3. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
4. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
5. Fabricate bollards with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
6. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
7. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
8. Prime bollards with primer specified in Section 09 96 00 High-Performance Coatings.
9. Cap bollards with 1/4-inch- thick steel plate.

10. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
11. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Slotted channel framing:

1. Multipurpose steel profiles by Unistrut, Power-Strut, Famet, or equal, complete with manufacturer's standard steel fasteners and connectors, nuts integrally self-locking or fitted with locking devices. Provide galvanized steel members where embedded in concrete or masonry, and factory-primed items elsewhere.
2. Provide hanger rods, nuts, bolts, connectors, and anchors with electro-galvanized finish.

C. Weld size shown on the design drawings are considered effective weld size and shall be increase in accordance with AWS as required by gaps or skews between components.

2.6 ALUMINUM CAGED LADDERS

A. Basis of design: O'Keeffe's, Inc.
B. Or equal.
C. Cage Ladder with High Parapet Access, Platform and No Return.

1. Model 533 as manufactured by O'Keeffe's Inc.

D. Materials:

1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

E. Finish: Paint. Urethane over chemically pretreated substrate. Color as called out on Drawings.
F. Prime exterior steel ladders, including treads, railings, brackets, and fasteners, with primer specified in Section 09 96 00 High-Performance Coatings.

2.7 FABRICATION - GENERAL

A. Comply with the reference standards and the following.
B. Engineer, fabricate and install exterior components to allow for expansion and contraction for a temperature range of 150-degree F without causing buckling, excessive opening of joints, and over-stressing of welds and fasteners.
C. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
D. Drill holes for bolts and screws. For screws exposed to view in finished surfaces use FHCS type with screw slots filled and finished flush and smooth with adjacent surfaces.
E. Form exposed work true to line and level with accurate angles and surfaces, and straight, sharp edges, so assembling can be done without filler pieces.
F. Shear and punch metals cleanly and accurately. Remove burrs.
G. Remove sharp or rough areas on exposed surfaces. Projecting edges are not permitted. Ease exposed edges to a radius of approximately 1/32-inch.
H. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Do not use stitch, spot or tack welds on exposed surfaces.
2. For work exposed to view, provide weld quality and finish equal to NOMMA Finish #1. Elsewhere provide weld quality and finish equal to NOMMA Finish #4.
3. Use materials, methods and welding sequence that minimize distortion and develop strength and corrosion resistance of base metals.
4. Obtain fusion without undercut or overlap.
5. Remove welding flux immediately.

6. At exposed connections, undercut edges of components to be welded, weld and finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
7. Where welds will be exposed to the elements, weld connections between various pieces continuously to prevent water intrusion in the weld area, or seal welded parts, after weld is ground, with silicone sealant specified in Section 07 92 00.

I. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the strength of the material.
J. Form exposed connections with flush, hairline joints, using concealed fasteners wherever possible. Cope intersections of rails and posts, weld joints, and grind smooth; butt weld end-to-end joints of railings or use welding connectors.
K. Bend pipe without collapsing or deforming its walls, to produce a smooth, uniform curved section and to maintain uniform sectional shape.
L. Fabricate joints that will be exposed to the weather with weep holes where water or condensation may accumulate.
M. Cut, reinforce, drill, punch, thread and tap metal work as required to receive finish hardware and similar items of work.
N. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
O. Provide supplementary parts necessary to complete each item of metal fabrication even though such parts may not be shown or specified. Provide all anchors, brackets, and sleeves for securing metal work to adjacent construction.
P. Remove blemishes by grinding before cleaning, treating, and applying specified finishes.

2.8 PIPE RAILING FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
D. Connect members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose when acceptable to the Architect. Weld connections continuously to match approved Samples.
E. Brackets, flanges, fittings, and anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other work, unless otherwise indicated.

1. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.
2. For railing posts set in concrete, unless otherwise indicated, provide preset sleeves of steel not less than 6-inch long with inside dimensions not less than 1/2-inch greater than outside dimensions of post, and steel plate forming bottom closure.

F. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.
G. Fabricate joints to be exposed to weather to be watertight.
H. Close exposed ends of handrail and railing members.
I. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4-inch or less.
J. Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 LADDER FABRICATION

A. Rungs: Not less than 1-1/4 inches in section and 18–3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

1. Rungs shall withstand a 1,500-pound load without deformation or failure.

B. Channel Side Rails: Not less than 1/8-inch wall thickness by 3 inches wide.
C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8-inch wall thickness by 3 inches wide. Construction shall be self-locking stainless-steel fasteners, full penetration TIG welds and clean, smooth, and burr-free surfaces.
D. Ship Ladders: Not less than 1-1/4 inches high, 4-1/8 inch deep and 2 feet wide; tread spacing shall be 1 foot on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches in diameter with hemispheric end caps.
E. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches above the landing and shall be fitted with deeply serrated, square, tubular grab rails.
F. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.
G. Security Doors: Formed 1/8-inch-thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.
H. Safety Cages:

1. Fabricate ladder safety cages to comply with authority having jurisdiction. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.
2. Safety cage hoops and vertical bars: 3/16 inch by 2 inches aluminum bar.

2.10 WELDING

A. Weld shop and field connections continuously in compliance with AWS D1.1, Structural Welding Code - Steel, and AWS D1.3, Structural Welding Code - Sheet Steel, unless bolted connections are specifically shown.
B. Grind welds that will remain exposed, smooth and flush to match and blend with parent metal surfaces. Match approved weld Samples.

2.11 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.
B. Maximum offset between components at joints: 1/16-inch except that at welded joints no offset is allowed.
C. Maximum misalignment of adjacent members: 1/16-inch.
D. Maximum bow: 1/8-inch in 48-inches.
E. Maximum deviation from plane: 1/16-inch in 48-inches.

2.12 GALVANIZING

A. See Section 05 03 12.

2.13 SHOP PRIMING-STEEL

A. Do not shop prime galvanized surfaces.
B. Surfaces exposed in the Work comply with : SSPC SP6 followed by application of zinc-rich primer.
C. Surfaces concealed from view: SSPC SP3 followed by rust inhibitive shop primer.
D. Shop prime metal assemblies as follows, unless otherwise specified in Section 09 96 00:

1. Prepare surfaces as specified above.
2. Remove loose mill scale, rust, cutting and punching burrs, oil, grease and other deleterious materials before priming.
3. Immediately after surface preparation, apply primer in compliance with its manufacturer's instructions to provide a uniform dry film thickness of not less than 1-1/2 mils per coat for rust-inhibitive primer and 3.5 to 3.5 mils for zinc-rich primer. Use painting methods that will result in full coverage of joints, corners, edges and all exposed surfaces.
4. Apply primer to completely cover all exposed surfaces as well as surfaces concealed after assembly. Stripe paint corners, crevices, bolts, welds, and sharp edges.
5. Allow paint to dry thoroughly before handling.
6. Apply one coat of primer to surfaces exposed in the finished work, and 2 coats to surfaces that will be inaccessible after their assembly or erection.

2.14 PROTECTIVE COATINGS

A. Apply a heavy coat of bituminous paint to metal surfaces that will be in contact with cementitious materials. Do not apply on exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.
C. Provide other trades with metal items to be embedded in their work. Where necessary, provide templates and instructions for this work.

3.2 INSTALLATION

A. Corrosion prevention: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials using heavy bituminous paint at least 10 DFT, hard plastic spacers, Teflon tape, or silicone or neoprene gaskets.
B. Fastening:

1. Provide anchorage devices and fasteners required for attaching metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors required.
2. Dry-pack metal fabrications supported on concrete and masonry as specified in Section 03 30 00 to provide firm, level bearing surfaces.

C. Cutting, fitting and placing:

1. Perform all cutting, drilling and fitting required for installation of metal fabrications.
2. Set items accurately in their proper location, alignment and elevation, plumb, level, true and free of rack as measured from established lines and levels.
3. Provide temporary bracing or anchors for items to be built into concrete, masonry or similar construction.
4. Fit exposed connections accurately to form flush, hairline joints.

5. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and flush with parent metal.

D. Field welding: Comply with AWS Code for procedures of manual shielded arc welding, appearance and quality of welds made, and methods used to correct faulty welds.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Installing metal bollards.

1. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

   a. Do not fill removable bollards with concrete.

2. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

   a. Embed anchor bolts at least 4 inches in concrete.

3. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
4. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

F. Metal Ships’ ladders and pipe crossovers:

1. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.
2. Secure pipe crossovers to construction to comply with manufacturer's written instructions.

G. Prefabricated units: Install as specified, and in compliance with their manufacturer's instructions.

H. Gate hardware:

1. Drill and tap gate frames on the job as required for installation of hardware.
2. Attach hardware accurately fitted to gates and frames with tamper-resistant or concealed means. Install ground-set items in concrete for anchorage.
3. Adjust to operate smoothly and without sticking and binding.
4. Gates shall close uniformly against frame. When open in any position, gates shall remain stationary, without drifting.
5. Latch shall engage strike and keeper regardless of the degree of force with which gates are closed.
6. Where so required for smooth and noiseless operation, lubricate hardware in compliance with its manufacturer instructions.

I. Installation tolerances: Adjust metal fabrications for squareness, alignment, twist, levelness and plumbness to the following tolerances.

1. Squareness where applicable: Plus or minus 1/16-inch, measured on the diagonal.
2. Alignment: Plus or minus 1/16-inch where fabrications are separated by one inch or more; where components join or are separated by less than one inch, components shall be aligned; no deviations permitted.
3. Twist: Plus or minus 1/16-inch, except that deviation shall be such that joined panelized components are flush at joints; no deviations permitted.
4. Plumbness: Plus or minus 1/16-inch, except that deviation shall be such that joined panelized components are flush at joints; no deviations permitted.
5. Levelness: 1/8-inch from level, except where tighter tolerances are required for joining or alignment with adjacent work.
6. Deviation from theoretical location in plan: 1/4-inch, except where tighter tolerances are required for joining or alignment with adjacent work.

3.3 FIELD QUALITY CONTROL

A. Extent and Testing Methodology: Owner’s Testing agency may randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

1. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.
2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

B. Touchup:

1. General: Immediately after erection, clean field welds, bolted connections and abraded areas, and proceed as follows.
2. Damaged primer: Clean the damaged area, sand smooth, re-clean and spot-prime with the same paint as that used for shop priming applied to the same dry film thickness as the undamaged primer; minimum thickness of 2 dry mils.
3. Damaged zinc coating:

    a. Clean abraded area in accordance with SSPC-SP11, “Power Tool Cleaning” to bare metal all welds and damaged zinc coating. Extend cleaning 2 inches past damaged area.
    b. Spot prime damaged area with Tnemec “94-H20 Hydro-Zinc” applied at 2.5 to 3.5 Mils DFT.

4. Where galvanized surface will remain exposed in the Work, repair damaged areas with zinc-based solder in accordance with ASTM A 780, regardless of the width of the abrasion (not limited to 3/16-inch).

END OF SECTION

SECTION 05 52 00 – STAINLESS STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior stainless-steel handrails and railings. (MT-7)
B. Related requirements:

1. Division 05 for railings and gates.
2. Division 14 for elevator hoistway door assemblies, cabs, and hoistway signals.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Preinstallation meeting: Before starting the shop drawings process, convene a meeting with the fabricator, the Contractor, the Owner, and the Architect to review in detail the work of this Section. Review and coordinate layouts for each railing and obtain Architect's approval prior to manufacture.
C. Delegated design: The work of this Section requires deferred approval and shall be engineered by its manufacturer and requires deferred approval from AHJ. Fees to obtain AHJ approval of the ladder are the Contractor’s responsibility.

1.3 SUBMITTALS

A. Shop Drawings: Large scale, dimensioned, indicating in detail methods of fabrication and assembly, welds, weight, materials, holes, lugs, inserts, fasteners, finishes and other pertinent data.
B. Data: Manufacturer Product Data consisting of the following.

1. Specifications and installation instructions for manufactured items.
2. Manufacturer's literature, including engineering data, for drilled-in anchors and shot pins.

C. Deferred approval: Structural calculations signed by a California-licensed civil or structural engineer, to demonstrate Code compliance for railings.
D. Closeout: With closeout submittals furnish to the Owner the fabricator's recommendations for maintenance of the ornamental metals surfaces.

1.4 QUALITY ASSURANCE

A. Deferred approval:

1. Drawings are schematics and indicate desired profile and design intent and Specifications minimum design criteria. The stair assemblies are design/build and Contractor is responsible for their engineering to withstand loads and other criteria prescribed by Code, indicated, or specified.
2. The Contractor is responsible for the design, engineering, fabrication, and installation of the stairs and their connections to the structure within the physical limitations indicated on the Drawings. Contractor shall obtain approval of the stair shop drawings and calculations from authorities having jurisdiction, and pay fees incurred thereby before start of installation.

B. Fabricator qualifications:

1. Successfully engaged in the manufacture of ornamental work, similar to the work described in this Section and indicated on the Drawings, for a minimum of 5 years.
2. Fabricator qualifications are subject to Architect's review and approval before subcontract is awarded.

C. Welding work qualifications:

1. Qualify welding procedures and welding operators in compliance with AWS "Qualification" requirements for AWS D1.1.
2. Verify that welders to be employed in this work have satisfactorily passed AWS qualification tests.
3. If recertification of welders is required, retesting will be Contractor's responsibility.

D. Mockups:

1. Erect at the Project site, unless otherwise acceptable to the Architect, a mockup of each assembly for the Architect's review and approval.
2. Make mockups complete with all accessories, features required for the final assemblies.
3. Mockups size and features are indicated on the Drawings.
4. Make such modifications as necessary to achieve mockups satisfactory to the Architect or remove and construct additional mockup(s).
5. Approved mockups shall serve as the standard for the same work on the building.
6. Remove mockups only after completion and acceptance of final work unless its incorporation in the Work is authorized by the Architect.
7. Protect mockups until their removal.

1.5 HANDLING

A. Protect fabrications with strippable coating or other forms of protection standard with the fabricator for exposed metal surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Select materials for their surface flatness, smoothness and freedom from blemishes wherever exposed to view in the finished work.
2. Materials shall have been cold-rolled, cold-finished, cold-drawn, extruded, stretcher-leveled and machine cut to the highest commercial standards for flatness, with edges and corners sharp and true to angle or curvature as required.
3. Exposed-to-view surfaces which exhibit pitting, seam marks, roller marks, oil-canning, stains, discolorations or other imperfections will not be acceptable and shall be removed from the job site.

B. Stainless steel:(http://en.wikipedia.org/wiki/Stainless_steel)

1. Type: ASTM A 666, Type 302/304.
2. Sheet, strip, plate, and flat bar: ASTM A 666, Type 304.
3. Bar stock: ASTM A 276.

4. Plate: ASTM A 167.
5. Tubing: ASTM A 269.

C. Welding electrodes and filler metal: Type and alloy recommended by producer of the metal to be welded, as required for color match, strength and compatibility in the fabricated items.
D. Fasteners: NAAMM Type 305 stainless steel.
E. Bituminous paint: Cold-applied asphalt mastic complying with SSPC Paint 12, except containing no asbestos fibers.

2.2 FABRICATION

A. Design components to allow for expansion and contraction for a temperature range of 120-degree F, ambient, 180-degree F, material surfaces, without causing buckling, excessive opening of joints, and overstressing of welds and fasteners.
B. Design assemblies to minimize site welding.
C. Form metal work to the required shapes.
D. Welding: Comply with AWS and the metal producer's recommendations.

1. Use welding for joining pieces together, unless otherwise accepted by the Architect on shop drawings.
2. Welds shall be continuous, except where stitch and spot welding are specifically permitted.
3. Make welded joints light-proof and tight. Close welded joint to air and water infiltration by welding interface completely.
4. Use only technicians qualified to weld stainless steel using TIG equipment.
5. Maintain proper welding temperature to avoid discoloring adjacent metal components.
6. Clamp parts in jigs during welding to avoid distortion.
7. Undercut metal edges where welds will be ground flush and dressed smooth.
8. Grind welds exposed to view flush, and fill and dress to match adjacent parent metal surfaces so that joint will be invisible in the Work.
9. Welds on or behind surfaces that will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration.
10. Remove weld spatter and welding oxides from welded surfaces.

E. Cut components square. Remove burrs from cut edges. Mill joints to a tight, hairline, flush fit. Cope or miter corner joints.
F. Unless otherwise shown or accepted on the shop drawings, conceal fasteners in the finish work. Back-up joints with either sleeves or back-up plates.
G. Built-in work: Furnish anchor bolts, inserts, plates and other anchorage devices, and all other items for metalwork to be built into concrete, masonry, or work of other trades, with necessary templates and instructions to facilitate proper placing and installation.

2.3 FINISHING EXPOSED METAL SURFACES

A. Finish exposed stainless steel surfaces with a NAAMM No. 4 finish (180 grit) with the grain belting running parallel with the long dimension of the component being fabricated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Furnish shop drawings, templates and inserts for work to be embedded in work of other trades.

3.3 INSTALLATION

A. General:

1. Do not install components damaged or defective in any way. Remove and replace members damaged during installation or thereafter, before Final Acceptance.
2. Do not cut, trim or weld parts during erection, where it would damage the finish, decrease the strength, or result in a visual imperfection or a failure in performance of the work.
3. Return components which require alteration to the shop for refabrication, if possible, or for replacement by new parts.
4. Install work with tight joints accurately fitted and aligned.
5. Where cutting is required for proper fitting and jointing, restore finish to eliminate evidence of corrective work.
6. Joints at changes in direction in stainless steel railings shall be shop welded; field joints shall be a minimum of 2 feet from a change in direction, and assembled with concealed sleeves or back-up plates and set screws.
7. Install this work with concealed fasteners.
8. Apply a bituminous coating of approximately 30 mils DFT, or other suitable permanent separator, on surfaces of dissimilar metals (except where exposed to view) and metal surfaces in contact with cementitious materials. Where the metals are exposed to view, provide a plastic or neoprene separators between dissimilar metals.
9. Comply with AWS Code for manual shielded metal-arc welding procedures, the appearance and quality of welds made, and the methods used in correcting welding work which must be approved by the Architect in each case.

B. Fastening to in-place construction:

1. Set this work accurately in location, alignment and elevation, plumb, level or sloped to follow ramped conditions, and true to line, measured from established lines and levels.
2. Provide required anchorage devices and fasteners for securing ornamental metals to in-place construction; coordinate the embedment of anchors with the work of Section 03 30 00.

3.4 FIELD QUALITY CONTROL

A. Control of corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

B. Extent and Testing Methodology: Owner's Testing agency may randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

1. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.
2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 TOUCHING-UP/CLEANING/PROTECTING

A. Field repair damaged components and finishes when the results are satisfactory to the Architect, otherwise replace with undamaged new components.
B. Restore protective coverings damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.
C. Clean and protect exposed surfaces at completion of this work and protect assemblies from damage and stains until final acceptance.

END OF SECTION

DIVISION 06
WOOD AND COMPOSITES

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rough carpentry Work.
2. Installation of glued laminated members, plywood web joists or wood chord metal web joists.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 10 00: Concrete Forming and Accessories.
3. Section 03 30 00: Cast-In-Place Concrete.
4. Section 06 20 00: Finish Carpentry.
5. Section 09 29 00: Gypsum Board.

1.2 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Work of this Section shall comply with CBC Chapter 23.

1.3 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Redwood structural and framing lumber shall be graded in accordance with Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.
2. Douglas fir, larch or hemlock structural and framing lumber shall be graded in accordance with the Standard Grading Rules of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Lumber Grading Rules of the Western Wood Products Association (WWPA).
3. Plywood shall conform to requirements of Product Standard PS 1, and shall be grade marked by a recognized grading agency (APA and PTL).

B. Lumber shall bear official grade mark of the association under whose rules it was graded or official grade mark of another recognized grading agency.

C. Structural and framing members 2-inch thick (nominal) and larger shall be air-dried to moisture content not to exceed 19 percent before installation.

D. Each piece of preservative treated lumber shall be identified by the Quality Mark of an approved inspection agency in accordance with CBC Chapter 23; refer to Section 01 4523: Testing and Inspection.

E. Lumber showing visible signs of mold growth:

1. Lumber showing visible signs of mold growth shall be removed from the project site or cleaned as outlined below.
2. The contractor is responsible for all costs associated with cleaning, post-cleaning testing, and reporting for lumber with mold.

a. Lumber that shows visible signs of mold growth prior to, or after installation, shall be cleaned pursuant to the current edition of USEPA's guidance publication "Mold Remediation in Schools and Commercial Buildings (EPA 402-K-01-001).

b. A minimum of 10 percent of the total locations cleaned must be sampled (tape lift method) post cleaning to ensure cleaning effort was successful. Cleaning will be considered acceptable when tape lift sample results evaluated by direct microscopic examination determine that the general abundance of mold is non-detect or rare (normal trapping to 1+).

c. A report prepared by a Certified Industrial Hygienist (CIH) that details the sampling and cleaning results shall be prepared and submitted to the OAR for review and approval of the LAUSD Office of Environmental Health and Safety.

d. Cleaned lumber shall not be installed or enclosed by finish materials until approval of test results. Cleaned lumber must meet moisture content requirements as required elsewhere in this specification prior to installation or application of finishes.

1.4 STORAGE, HANDLING AND PROTECTION

A. The materials supplied as part of the Work of this section shall be protected from exposure to inclement weather before being covered by other Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber: Structural and framing lumber shall be of following species and grades:

	INSTALLATION	SPECIES	GRADE
1.	Subfloor, wall sheathing, roof sheathing and ceiling furring	Douglas fir and larch	Construction Board, WCLIB; WWPA
2.	Posts, (5-inch by 5-inch and larger, width not more than 2 inches greater than thickness).	Douglas fir and larch	No. 1 or better Structural Posts and Timbers, WCLIB. No. 1 or better Post and Timbers, WWPA.
3.	Beams, girders and truss members (5-inch and thicker, rectangular, width more than 2-inches greater than thickness) where exposed as finish members.	Douglas fir and larch	No. 1 or better Structural Beams and Stringers, WCLIB; WWPA.
4.	Joists, rafters, lintels, posts, mullions and members (2 to 4-inch thick, 2 to 4-inch wide)	Douglas fir and larch	No. 1 or better; Structural Light Framing, WCLIB;
5.	Other lumber (2 to 4-inch thick,	Douglas fir	Construction Light

	2 to 4-inch wide) not specified in subparagraph 5 above.	and larch	Framing WCLIB; WWPA
6.	Framing lumber (2 to 4-inch thick, 5-inch and wider).	Douglas fir and Larch	No. 1 or better Structural Joists and Planks, WCLIB; WWPA.
7.	Mudsills and plates in contact with earth.	Douglas fir and Larch Treated	Same as subparagraphs 5 and 6.
8.	Sills or plates installed on concrete or masonry surfaces 6 inches or less above earth or finish grade.	Douglas fir and Larch Treated	Same as subparagraphs 5 and 6.
9.	Sills, foundation plates and sleepers installed on concrete, masonry foundations, or installed on concrete slab in direct contact with earth.	Douglas fir and Larch treated	Same as subparagraphs 5 and 6.
10.	Miscellaneous nailing strips and blocks embedded in concrete or masonry.	Douglas fir and Larch treated	Same as subparagraphs 5 and 6.

B. Plywood: Plywood furnished for structural purposes, when exposed outdoors, shall be exterior type plywood. Other plywood furnished for structural purposes shall be exterior type, or Exposure 1.

C. OSB Board or Panels:

1. Oriented strand board or panels shall not be furnished as part of the Work of this section.

D. Preservative Treated Wood:

1. Wood and plywood specified; as treated wood shall be pressure treated wood in accordance with CBC requirements.

2. Seasoning: Treated lumber shall be air seasoned after treatment, for a minimum of two weeks before installation. Moisture content shall be 15 percent maximum.

3. Creosote or arsenic is not permitted for treating wood.

4. When treated wood member have been notched, dapped, drilled, or cut, such newly cut surfaces shall be painted with a heavy coat of the same preservative material originally provided for treatment of wood member.

E. Fire Retardant Protection: Wood and plywood specified as fire retardant protected wood shall be treated by approved methods and materials and shall be dried following treatment to maximum moisture content as follows:

1. Solid sawn lumber 2-inch thick or less: 19 percent.

2. Plywood: 15 percent.

F. Plywood Subflooring: Underlayment, Group 1, Exposure 1; of thickness indicated.

G. Mineral Fiber Panels: Asbestos-free, thickness as indicated.

H. Adhesive: Elastomeric adhesive – follow manufacturer's installation instructions. Product must be approved by OWNER Office of Environmental Health and Safety and conform to ASTM D 3498 or APA-AFG-01.

PART 3 - EXECUTION

3.1 FASTENINGS

A. Nails and Spikes:

1. Furnish only common wire nails or spikes whenever indicated, specified or required.
2. Whenever necessary to prevent splitting, holes shall be pre-drilled for nails and spikes.
3. Nails in plywood shall not be overdriven.
4. Machine Applied Nailing: Use of machine nailing is subject to a satisfactory Project site demonstration for each Project and approval by the Architect or structural engineer retained by the Architect as an Architect Consultant and DSA. Installation is subject to continued satisfactory performance. Machine nailing is not permitted for 5/16 inch plywood. Do not permit nail heads to penetrate outer ply. Maintain minimum allowable edge distances when installing nails.

B. Lag Screws:

1. When installing lag screws in a wood member, pre-drill hole as required by the CBC.
2. Lag screws, which bear on wood, shall be fitted with standard steel plate washers under head. Lag screws shall be screwed and not driven into place.

C. Bolts:

1. Lumber and timber to be fastened together with bolts shall be clamped together with holes for bolts bored true to line.
2. Bolts shall be fitted with steel plates or standard cut washers under heads and nuts. Bolts shall be tightened when installed and again before completion of the Work of this section.

D. Wood Screws: When installing wood screws, pre-drill holes as required by the CBC.

E. Metal Framing Devices: Framing anchors, joist hangers, ties, and other mechanical fastenings shall be galvanized or furnished with a rust inhibitive coating. Nails and fastenings shall be of the type recommended by manufacturer.

F. Powder Driven Fasteners:

1. Loads shall not exceed 75 pounds unless indicated on the Drawings or when reviewed by the Architect.
2. The operator, tool, and fastener shall perform the following as observed by the Inspector.
   a. Observe installation of first 10 fasteners.
   b. Test the first 10 fasteners by performing a pullout test. Load shall be at least twice the design load, or 150 pounds, whichever is greater.
   c. Random testing:
      1) Load less than 75 pounds - approximately 1 in 10 pins.

2) Load 75 pounds or greater - 1/2 of the pins.

3. Failure of any test will result in testing of all installed pins.

4. Nail heads shall not break the outer skin of sheathing.

5. Non-compliant pins shall be replaced.

3.2 INSTALLATION

A. Stud Walls, Partitions and Furring:

1. Wood stud walls, partitions and vertical furring shall be constructed of members of size and spacing indicated. Provide single treated plate at bottom and double plate at top unless otherwise indicated. Interior, nonbearing non-shear partitions may be framed with a single top plate, installed to provide overlapping at corners and at intersections with other wall and partitions or by metal ties as detailed.

2. Walls and partitions shall be provided with horizontal staggered blocking at least 2 inch nominal thickness and same width as studs, fitted snugly, and nailed into studs. Blocking shall be installed at mid-height of partition or not more than 7 feet on center vertically. Install wood backing on top of top plate wherever necessary for nailing of lath or gypsum board.

3. Walls, partitions and furred spaces shall be provided with 2-inch nominal thickness wood firestops, same width as space to be firestopped, at ceiling line, mid-height of partition and at floor line. Firestops at floor line are not required when floor is concrete. If width of opening is such that more than one piece of lumber is necessary, provide two thicknesses of one inch nominal material installed with staggered joints.

4. Firestops shall be installed in stud walls and partitions, including furred spaces, so the maximum dimension of any concealed space is not over 10 feet.

5. Corners, and where wood stud walls and wood vertical furring meet, shall be constructed of triple studs. Openings in stud walls and partitions shall be provided with headers as indicated and a minimum of 2 studs at jambs, one stud of which may be cut to support header in bearing.

6. Where wood and masonry or concrete walls intersect, end stud shall be fastened at top, bottom and mid-height with one 1/2 inch diameter bolt through stud and embedded in masonry or concrete a minimum of 4 inches. Bolts shall be provided with washers under nuts.

7. Sills under bearing, exterior or shear walls shall be bolted to concrete with 5/8 inch diameter by 12-inch long bolts with nuts and washers, spaced not more than 4 feet on center unless noted otherwise. There shall be a bolt within 9 inches of each end of each piece of sill plate. Sills shall be installed and leveled with shims, washers, with nuts tightened to level bearing. Space between sill and concrete shall be dry packed with cement grout.

B. Floor Joists, Roof and Ceiling Framing:

1. Wood joists shall be of the size and spacing indicated, installed with crown edge up, and shall have at least 4-inch bearing at supports. Provide 2-inch solid blocking, cut in between joists, same depth as joists, at ends and bearings, unless otherwise indicated.

2. Floor joists of more than 4 inches in depth and roof joists of more than 8 inches in depth shall be provided with bridging. Floor joists shall be bridged every 8 feet with solid blocking or metal cross bridging. Roof joists shall be bridged every 10 feet.

3. Joists under and parallel to bearing partitions shall be doubled and nailed or bolted together as detailed. Whenever a partition containing piping runs parallel to floor joists, joists underneath shall be doubled and spaced to permit passage of pipes and blocked with solid blocking spaced at not more than 4 feet intervals.

4. Trimmer and header joists shall be doubled, when span of header exceeds 4 feet. Ends of header joists more than 6 feet long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition, or wall. Tail joists over 12 feet long shall be supported at header by framing anchors or on ledger strips at least 2 by 4.

5. Provide solid blocking between rafters and ceiling joists over partitions and at end supports where indicated.

C. Beams, Girders and Joists:

1. Ends of wood beams, girders and joists which are 2 feet or less above finished outside grade and which abut, but do not enter concrete or masonry walls, as well as wood blocking used in connection with ends of those members shall be treated with wood preservative.

2. Where wood beams, girders and joists enter masonry or concrete walls 2 feet or less above outside wall, metal wall boxes or equivalent moisture barriers shall be provided between wood and masonry or concrete.

D. Subflooring:

1. Floor sheathing: Plywood of thickness and nailing indicated. Install with the face grain direction across supports, end joints staggered and centered over supports. Provide solid blocking under plywood edges where indicated. In addition to nailing, sheets of plywood flooring shall be secured in place with elastomeric adhesive, installed at beams, joints, perimeter supports and panel edges.

E. Roof:

1. Plywood roof sheathing shall be Structural I, Grade C-D, Exposure 1, thickness as indicated.

2. Where exposed roof sheathing is indicated, area shall be sheathed solid with dressed and center matched, V-jointed boards of sizes indicated. Boards shall be installed perpendicular to supports.

3. Soffits of overhanging eaves, where indicated, shall be boxed-in using Group I, Exterior Type, Grade A-C, plywood, thickness as indicated.

4. Provide and install metal H-clips of required size, midway between rafters at unsupported edge joints of plywood roof sheathing where rafters are spaced at 24 inches on center. Clips shall be Plyclips, by Timber Fasteners Inc., Panel Clips by Simpson Co., USP Structural Connectors, or equal.

F. Attic Space Partitions and Attic Walkways:

1. Attic space partitions shall be constructed of 2 by 4 wood members spaced at 2 feet on center maximum with 5/8 inch gypsum board.

2. Doors in attic space partitions shall be self-closing, of the same sheathing material as partition, constructed with 2 battens and a diagonal brace across back.

3. Shear walls passing through attic space shall be sheathed with 5/8 inch gypsum board on each side.

4. Attic walkways shall be constructed of 2 by 12 planks installed one-inch apart and nailed at each support with three 16d nails.

G. Furring:

1. Rafters or ceiling joists indicated to be furred for support of materials other than acoustical tile shall be furred with 2 by 4 wood members installed at right angles to supports, spaced as indicated and nailed in place. Furring shall be aligned, and bottoms shall be leveled by installing wood shims as required, and nailed as indicated.

2. Furring for protective wall padding in gymnasium shall be 1 by 3 Douglas fir, Construction Boards, S1S1E; applied horizontally to concrete walls at top and bottom of padding panels; and at uniform intermediate spacing not more than 18 inches on center. Stripping shall be shimmed where required, aligned to a true plane, and secured to concrete walls with concrete nails at not more than 18 inches on center.

H. Furring: Where metal furring is not indicated or specified, provide wood furring at points indicated and required for concealing conduit, piping, structural framing or other unfinished materials. Wood furring shall be 2-by studs of required width. Vertical members contacting concrete or masonry shall be attached as specified for anchoring interior wood stud partitions.

I. Grounds:

1. Provide and set wood grounds at points where wood trim occurs and work is to be plastered. Grounds at 3/4 inch metal lath shall be 5/8 inch thick, net, 1 ½-inch wide Douglas Fir, S1S. Grounds shall be doubled where trim member exceeds 5-inch width, or wherever indicated. Grounds shall be applied after lath has been installed set plumb, level and true to line.

2. Apply grounds over wood framed surfaces and lath and securely nail to wood backing at each stud or bearing. Grounds applied over steel channel studs and lath shall be securely nailed at each stud or bearing to nail-blocks provided and installed in metal studs.

3. Grounds applied to concrete surfaces shall be securely nailed to woodblocks provided and built into concrete.

J. Nailing Strips and Plates:

1. Provide wood nailing strips, plates and blocking indicated or required. Nailing strips in connection with metal work shall be bolted to metal. Wood nailing blocks for securing grounds shall be built into concrete, or masonry.

2. Nailing schedule shall comply with CBC requirements.

3. Treated wood nailing strips for lightweight insulated concrete roof decks at eaves, ridges, rakes, base of curbs and wherever else indicated, shall be provided and installed. Strips shall be treated Douglas fir, 4 inches (nominal) width by thickness of insulated concrete.

K. Wood Backing: Provide wood backing as indicated and as required to receive plumbing, electrical fixtures and equipment, cabinets, door stop plates and other fixed equipment.

L. Wood Bucks: Furnish and set wood bucks to form openings for doors and other openings in concrete or masonry walls and in steel stud or channel partitions and furring. Bucks shall be Douglas fir, S1S2E, 2 inches (nominal) thickness and of width indicated or required. Bucks in connection with concrete shall be bolted thereto, and bucks in masonry walls shall be attached by means of strap anchors embedded in masonry joints. Bucks in connection with steel studs and metal channels shall be secured with nails or screws spaced not to exceed 24 inches on centers.

M. Bench Tops and Backs: Tops and backs shall be 3/4 inch thick asbestos free board, fabricated to minimize number of joints. Edges shall be neatly cut, smoothly finished and joints accurately fitted and butted. Tops and backs shall be secured with countersunk flathead galvanized wood screws. At bench with steel pan, apply with manufacturer's recommended adhesive. Cut and drill as required for Work to be attached to benches.

3.3 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.4 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Wood nailers and blockings, and plywood sheathing.
2. Rough hardware.

B. Related requirements:

1. Section 09 90 00 for painting plywood backboards.
2. Section 27 11 00 for backboards for Communication Rooms.

1.2 SUBMITTALS

A. Wood treatment data: Treatment manufacturer's instructions for proper use of each type of treated material.

B. Pressure treatment:

1. For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained and conformance with applicable standards.
2. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 19 percent prior to shipment to project site.
3.

1.3 QUALITY ASSURANCE

A. Fire-retardant wood products shall be manufactured under the independent third party inspection of UL

B. Follow-Up Service and each piece shall bear the UL classified mark indicating the extended ASTM E 84 test

C. Each piece shall be labeled kiln dried after treatment (KDAT).

1.4 HANDLING

A. Procedure: In accordance with AWPA recommendations for storage and protection of pressure-treated wood.

B. Do not store materials in wet or damp areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nailers and blockings:

1. No. 1 or No. 2 grade Douglas fir, S4S, seasoned to moisture content of 19 percent maximum and stamped S-Dry, graded in compliance with WCLIB Grading Rules.
2. If specifications for pressure treatment state the maximum percentages of moisture content at the time of treatment, comply with those requirements in lieu of the above.

B. Plywood:

1. Telephone and electrical equipment backing panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, thickness indicated or, if not indicated, not less than 1/2 inch thick.
2. Elsewhere: Softwood plywood APA, Exterior Grade, C-C Plugged.

C. Rough hardware:

1. General: Use hot-dip galvanized (not electro-plated) Type 316 stainless steel fasteners complying with G185 to attach pressure-treated wood.
2. For fastening lumber-to-lumber: Cement-coated or annular threaded nails of sufficient length to penetrate a minimum of 1-1/4-inch into adjoining members, or stove or lag bolts used with washers.
3. For fastening plywood-to-lumber: Ring shank or annular threaded nails; 8d for 1/2-inch plywood and 10d for 3/4-inch plywood.
4. For fastening plywood or lumber to steel: Minimum #10 galvanized full threaded screws driven thru 5/8-inch diameter steel washers.
5. For fastening plywood or lumber to concrete or masonry: Corrosion-resistant drilled expansion type anchors or power-driven anchors by Hilti Fastening Systems, Molly Division of USM Corp., Redhead, or equal, capable of resisting a withdrawal force of 400 lb. each without failure.

2.2 TREATMENT OF LUMBER AND PLYWOOD

A. Preservative treatment by pressure process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber not in contact with the ground and continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Kiln-dry material after treatment to maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
3. Treatment of wood nailers used in conjunction with roofing membrane shall be compatible with the roofing bitumen; oil-based preservatives are not acceptable.

B. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

2.3 FIRE-RETARDANT TREATED WOOD

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, US Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to AHJ.

B. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664 for lumber and ASTM D 5516 for plywood**.**

C. Use treatment free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, urea formaldehyde, and that does not promote corrosion of metal fasteners.

1. Exterior: “Exterior FRX” by Hoover Treated Wood Products (basis of design), FRX FRT Wood by Arch Wood Protection, or equal.
2. Interior: “Pyro-Guard” by Hoover Treated Wood Products, Dricon FRT by Arch Wood Protection, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Paint backboard panels before installation as specified in Section 09 90 00.

3.3 INSTALLATION

A. Subdrill holes in pieces where splitting may occur; size holes slightly smaller than diameter of nail.
B. Do not drive nails closer to edge of lumber than 1/4 length.
C. Remove lumber split in nailing and replace with sound members.
D. Make joints accurately and neatly, square, flush and tight.
E. Install wood screws and lag bolts with complete penetration to head. Bore lead holes equal to root diameter of the screw or bolt. Drive flush or recess with nailer face.
F. Pressure-treated wood products: Do not rip or mill treated lumber. End cuts, drilling holes and joining cuts are permitted. Plywood may be cut in any direction.

1. Use pressure-treated wood where required by Code and as specified above.
2. Use fire-treated wood where required for blockings and nailers located in metal-framed walls, partitions and ceilings.

G. Provide nailers and blockings where indicated and required.

1. Template and drill to match anchor bolts in steel members, concrete and masonry.
2. Where materials are applied over flush nailer surfaces, use carriage bolts with heads drawn flush into top of nailer or blockings, or counterbore holes to recess washers and heads of nuts.

3.4 ANCHORAGE

A. Fastening lumber or plywood to lumber:

1. Space nails a maximum of 12 inches o.c. and stagger across face of piece. Locate fastener also within 3 inches of each end of piece.
2. Drive nail heads flush with wood surfaces. Nails shall penetrate adjoining piece a minimum of 1-1/4-inch.

B. Fastening lumber or plywood to concrete or to masonry:

1. Space anchors a maximum of 36 inches o.c. and stagger if lumber is more than 5 inches wide.

2. Make anchor heads flat or countersunk flush with surface, but not countersunk more than 1/3 the thickness of piece to be fastened.
3. Anchor withdrawal resistance shall be a minimum of 400 lb. per anchor, or number of fasteners increased accordingly from that specified. Minimum penetration of 1-1/2-inch into concrete or masonry.

C. Fastening lumber or plywood to steel:

1. Space screws a maximum of 24 inches o.c. and stagger if lumber is more than 5 inches wide.
2. Drive screw heads flush with face of plywood or lumber.
3. Anchor shall penetrate a minimum of 1/4 inch through the steel.
4.

3.5 CLEANUP

A. Comply with the requirements of Division One.
B. Do not bury wood of any type on the jobsite.

END OF SECTION

SECTION 06 16 43 - GYPSUM SHEATHING BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes gypsum sheathing board on exterior face of exterior walls.
B. Related requirements:

1. Gypsum cover board is specified in Division 07.
2. Gypsum board is specified in Division 09.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data for sheathing and fasteners. Include copies of approval for the assemblies by authorities having jurisdiction where used in fire-rated assemblies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gypsum sheathing: One of the following of the thickness indicated, or equal complying with ASTM C 1177.

1. G-P Gypsum Products “Dens-Glass Gold” (Standard and Type X) sheathing board complying with ASTM C 1177 (basis of design).
2. National Gypsum “Goldbond E^2 XP.”
3. USG “Securock Glass-Mat Sheathing.”
4. Temple Inland “GreenGlass.”
5. CertainTeed “GlasRoc Sheathing.”

B. Screws: Steel drill screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Diameter and length to satisfy Code requirement.
C. Gypsum sheathing tape: 3M contractor sheathing tape NO.8086-inch by 3M Co., “Perm-A-Barrier” wall seam tape by WR Grace & CO., “108JTN” by Royston Laboratories, or “Polyken 610” by Polyken Technologies; use only tape approved by the sheathing manufacturers**.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing to support sheathing board and verify that the contact surface of any framing or furring member does not vary more than 1/4-inch from the plane of adjacent members.
B. Verify that studs, blocking and supporting materials are in place and ready for sheathing attachment prior to starting work.
C. Coordinate the exterior placement of electrical, mechanical and plumbing wall devices, accessories and access panels, wall signage, and other type wall construction with other trades before proceeding with work and during installation.
D. Correct detrimental conditions before proceeding with installation.

3.2 APPLICATION

A. General:

1. Use appropriate length boards to minimize end joints.
2. Place edge joints parallel to, and over framing members. Stagger end joints, if required.

B. Install boards with long edge perpendicular to framing. Butt joints between panels loosely. Do not force panels into place.
C. When fastening the board, proceed from the center towards ends and edges using power screwdriver recommended by the manufacturer to drive screws.
D. Drive fasteners to bear tight against and flush with the surface of the sheathing but do not break the fiberglass mesh.
E. Locate fasteners not closer than 3/8-inch from the edge and the ends of the sheathing panels.

END OF SECTION

SECTION 06 18 13 - GLUED-LAMINATED BEAMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glued-laminated (glue-lam) beams.
2. Connectors, anchors and accessories.

B. Related requirements: Rough carpentry: Section 06 10 00.

1.2 SUBMITTALS

A. Data:

1. Manufacturer Product Data including specifications and installation instructions covering lumber, adhesives, fabrication process, preservative treatment, accessories and protection.
2. Certification indicating that glue-lam beams comply with requirements of ANSI/AITC A190.1.

B. Shop Drawings:

1. Large scale, dimensioned, of glue-lam beams, showing species, and stress grade of lumber, type of glue, and all other pertinent data of each member.
2. Indicate species, stress grade of lumber, type of glue, and other variables in the required work.

C. Certificate: AITC inspection certificate certifying that glue-lam members were produced in compliance with the provisions of the referenced AITC 200, Inspection Manual.

1.3 QUALITY ASSURANCE

A. Manufacturer's qualifications: Provide factory glue-lam beams produced by an AITC-licensed firm, qualified to apply the AITC "Quality Inspected" mark, and operating in compliance with AITC 200.
B. Factory-mark each glue-lam beam with the AITC "Quality Inspected" mark.

1.4 HANDLING

A. Procedure:

1. In accordance with the requirements of AITC 111.
2. Keep glue-lam members dry during delivery, storage, handling and erection.

B. Protection: Maintain protective covering until building enclosure is completed and until final finishing of exterior work is ready to proceed.
C. Delivery: Schedule delivery and installation of glue-lams to minimize on-site storage.

D. Storage:

1. Do not store glue-lam units in areas of either excessively high or excessively low relative humidity; comply with manufacturer's printed instructions.
2. If members will be stored before erection, place them on blocks well off ground with individual members separated for air circulation.
3. Leave wrappings intact but slit or puncture lower side to permit drainage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. AWPA Use Category: UC3A, exterior construction, above ground, coated and rapid run-off.

2.2 MATERIALS

A. Glue-lam wood members:

1. Lumber: Comply with ANSI/AITC A190.1 and applicable lumber association standards cited therein for grades required to achieve glue-lam requirements for design values, appearance, fabrication limitations and species.
2. Stress values: As indicated on the Drawings.
3. Lumber species: Douglas Fir. Lumber specie applies to all the laminations in the glue-laminated member; do not combine species.
4. Appearance: Architectural Grade.
5. Adhesive: ASTM D 2559, CSA, JAS, Din 1052, "wet-use" type.
6. End sealer: Manufacturer's standard transparent, colorless wood sealer, effective in retarding transmission of moisture at cross-grain cuts.
7. Penetrating sealer: Manufacturer's standard translucent penetrating wood sealer, which will not interfere with application of wood stain and transparent finish, or paint finish, as indicated.

B. Connectors, anchors, and accessories:

1. Provide type 316 stainless steel bolts, nuts, and other standard fasteners as required for installation.
2. Plug countersunk fasteners with Douglas Fir glued plugs.

C. Welding electrodes: As recommended by AWS for the metal alloys to be welded.

2.3 FABRICATION

A. General: Comply with ANSI A190.

1. Shop-fabricate for connections and connecting hardware to greatest extent feasible, including drilling of bolt holes.
2. Provide grade as indicated on structural Drawings, complying with AITC 110.

B. Preservative treatment:

1. After fabrication, preserve with Pentachlorophenol in light solvent. Apply so as not to affect the natural color of the wood.
2. End-cut sealing: Immediately after end-cutting each member to final length, and after wood treatment (if any), apply a saturation coat of end sealer to ends and other crosscut surfaces, keeping surfaces "flood-coated" for not less than 10 minutes.

C. Seal coat: After fabrication and sanding of each unit, and end coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.
D. Welding: Welding of steel connection assemblies shall conform to the referenced AWS D1.1. Welders shall be qualified in compliance with Building Code requirements.
E. Factory-applied protection:

1. Before shipping or exposing to outdoor conditions, individually wrap each member with manufacturer's standard, opaque, durable, water-resistant, plasti-coated paper covering, with water-resistant seams.
2. At manufacturer's option, small members of uniform size may be bundle-wrapped, in lieu of individual wrappings.

2.4 FINISH

A. Shop applied System 5 Varnish Conversion system in accordance with WI’s North American Architectural Woodwork Standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Plan and execute erection procedures so that close fit and neat appearance of joints and structure will not be impaired. When hoisting members into place, use padded or non-marring slings, and protect corners with wood blocking.
B. Install miscellaneous steel connectors, anchors, and accessories.
C. Erect glue-lam members plumb and fasten securely in place in the locations shown on the Drawings.
D. Avoid cutting beams during erection, except for fastener drilling and other minor cutting. Coat cuts with end sealer as specified under "Fabrication" above.
E. Do not remove wrapping on individually wrapped members until it will serve no useful purpose, including protection from weather, soiling and damage from work of other trades. Coordinate removal of wrapping with finishing work specified in Section 09900. Retain wrapping wherever it can serve as a painting shield.
F. Repair (or replace when repairs are not acceptable to the Architect) damaged glue-lam members with new materials.
G. Field seal the plugs installed during installation with a finish recommended by the shop-applied finish manufacturer.

END OF SECTION

SECTION 06 41 16 – PLASTIC-LAMINATE-CLAD ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Plastic laminate-clad casework.
2. Hardware for the casework.
3. Structural supports incorporated into wood casework.

B. Factory finishing.

1. Items associated or integral with architectural woodwork, including, but not limited to:

a. Supports, reinforcement, and like components.
b. Hardware and accessories.
c. Concealed steel supports

C. Related requirements:

1. Other Section of Division 06 for wood blocking or grounds inside finished walls or above finished ceilings.
2. Division 23 for plumbing fixtures and fittings installed in countertops.

1.2 REFERENCES

A. Minimum standards for work in this Section shall conform to those listed and referenced in the Woodwork Institute (WI) and North American Architectural Woodwork Standards (NAAWS).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate placement of backing plates and studs in walls to receive casework with the appropriate trades. Review, and annotate where required, their Shop Drawings before those are submitted to the Architect.
B. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. The Drawings are diagrammatic and show required profiles and dimensions. Assembly details are left to the Contractor and shall comply with WI standards provided the profiles and dimensions of the casework remain as indicated.

1. Comply with Woodwork Institute's (WI) North America Architectural Standards (NAAWS) standards, current edition.
2. Furnish WI Certified Compliance Label on the first page of Shop Drawings.

3. Submit large scale, dimensioned, Shop Drawings showing location of each item of casework, dimensioned plans and elevations, large-scale details, attachment devices, finishes, and finish hardware type and location.

   a. Include hardware list, identifying each item by manufacturer, catalog number, size, finish and intended use. Include catalog cut sheets.
   b. Indicate method of seismic construction by WI-Seismic Test Codes Number.
   c. Coordinate Shop Drawings with the work of related trades which is a part of, or will be incorporated with the architectural woodwork, such as plumbing, electrical, and electronic equipment, along with adjacent and abutting materials to which this work is to be secured. Obtain the approval of the millwork Shop Drawings by these related trades (as evidenced by their stamp and signature thereon) before submitting Shop Drawings to the Architect.

B. Closeout:

1. Deliver all documentation required herein, including but not limited to:

   a. WI Certificates of Compliance.
   b. “As built” shop drawings reflecting all changes made during the project

2. Deliver a minimum of 4 keys for each lock to the District Representative. Label with individual tags indicating lock location(s).

1.5 QUALITY ASSURANCE

A. Manufacturer qualifications:

1. Firm (woodwork manufacturer) with not less than 5 years of production experience similar to this Project, whose qualifications indicate the ability to comply with the requirements of this Section.
2. The woodwork manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.

B. Installer qualifications:

1. Manufacturer of casework, or
2. Firm licensed by WI under their "Certified Compliance Program," or
3. Firm specializing in custom millwork with 5 years’ experience in installation of custom millwork similar to that required for this Project.

C. Mockup:

1. Before starting production work, assemble a mockup of a base cabinet with one drawer and one door, and a countertop, for the Architect's review and approval. Mockup shall be complete with hardware and finished as specified.
2. Mockup must be located at the Project site.
3. Finish the mockup as intended for the finish work.
4. Approved mockup will be used as a standard for the Work.
5. Approved mockup may be used for the Project upon approval of Architect.

D. Requirements of regulatory agencies: Provide evidence of compliance with Code for architectural woodwork.

1. Particle board, MDF, and hardwood plywood used in this project must comply with California Air Resource Board standards for formaldehyde emissions.

E. Single source responsibility: A single manufacturer shall produce and install the work of this Section.
F. Certified compliance:

1. Before delivery to the jobsite the woodwork supplier shall provide a WI “Certified Compliance” Certificate indicating the millwork products being supplied and Certifying that these products meet the requirements of the Grade or Grades specified.
2. Each piece of paneling shall bear a WI Certified Compliance Label.
3. At completion of installation the woodwork installer shall provide a WI Certified Compliance Certificate indicating the products installed and certifying that the installation of these products meets the requirements of the NAAWS Grade specified.
4. Fees charged by the WI for their Certified Compliance program are the responsibility of the Contractor and shall be included in the bid.

1.6 HANDLING

A. Procedure: In accordance with NAAWS "Recommended Care and Storage of Architectural Woodwork"
B. Delivery:

1. Deliver materials to Project site in protective wrappings clearly labeled with identification of manufacturer, item name, and specific installation location.
2. Deliver millwork only when the area of operation is enclosed, all plaster and concrete work dry, and the area broom clean.

C. Storage:

1. Store in a clean storage area, well ventilated and protected from direct sunlight, excessive heat, rain or moisture, in which the relative humidity is between 45 percent and 65 percent at 60 to 90-degree F, and Equilibrium Moisture Content conditions between 8 percent and 12 percent.
2. The air conditioning or heating system shall be on and functioning and the architectural millwork shall be acclimated to these conditions for 72 hours prior to installation.
3. Do not subject casework to abnormal heat, extreme dryness, humid conditions, sudden changes in temperature, or direct sunlight.
4. Store cabinets carefully and set or store on a level floor. Protect the exposed finished portions from bumping, scratching, staining and other damage.

D. Handling: Handle with clean hands, use care not to slide one item over the other, and when primed or sealed, properly re-stack when dry.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Lumber:

1. In accordance with the NAAWS Grade specified for the product being fabricated. Moisture content shall be 6 percent to 12 percent for boards up to 2-inch nominal thickness and shall not exceed 19 percent for thicker pieces.
2. Lumber shall be Birch or Poplar.

B. Veneer:

1. In accordance with the NAAWS requirements for its use and grade(s) specified.
2. Veneer shall be any close-grained hardwood suitable to receive an opaque finish.

C. Core: MDF meeting the requirements of NAAWS.
D. Veneer core plywood: Classic Core by Columbia Forest Products, or equal void less veneer hardwood plywood.
E. Hardboard: AHA A135.4.
F. Plastic laminate:

1. See PLAM-1 and PLAM-2 on sheet A610 -Interior Finish Materials sheet.
    a. Or equal.

2. Complying with the requirements of the NAAWS for its intended use.
3. Colors and textures indicated or selected by the Architect.
4. Where edge is exposed in the Work, provide color core laminate.

G. Cabinet liner: Type CLS.
H. Edgeband: PVC.
I. Adhesives: Type I.
J. Finish hardware:

1. Hinges:
    a. Grade 1 (institutional), or Grade 2, concealed (European style) with 3-way independent adjustment.
    b. Self-closing, 170-degree opening, except 90-degree where door opens against a wall, or otherwise limited to 90-degree.

2. Drawer slides: WI-approved, self-closing metal runners with ball-bearing rollers, full extension type, side mounted.
    a. Pencil drawers: 50 lb rated.
    b. General purpose drawers: 75 lb rated.
    c. General purpose drawers more than 24-inch wide or 6-inch deep: 100 lb rated.
    d. File drawers: 100 lb rated.
    e. Lateral file drawers more than 24 inches wide: 150 lb rated.
    f. Drawer guides: full extension NAAWS-approved.

3. Drawer Pulls: Equal to DP269B 7-7/8-inch drop edge drawer pulls by Mockett.
    a. Finish: Brushed black (90).

4. Shelf supports for adjustable shelves in wall-hung cabinets and the upper half of tall cabinets: Designed to prevent shelves from sliding forward in a seismic event.
5. Bored hole shelf support systems and metal shelf ladders have both been determined to provide satisfactory support.
6. Drawer and Cabinet Locks: Equal to National Cabinet Lock.
    a. Cabinet Doors: C8173, C8174, or C8175.
    b. Drawers: C8177, C8178 or C8179.
    c. Provide a minimum of 4 keys per lock.

7. Keying:

a. Key locks inside one room alike. Furnish 3 keys for each lock keyed separately, and 2 keys for each lock in keyed alike groups. Master keys shall be tagged and delivered to the Inspector of Record (IOR). Locks and keys shall be stamped with coded set number / direct digit.
b. Cabinet locks shall be master-keyed and keyed alike. Backside of cabinet lock bolts (on visible side following installation) and change keys shall be stamped with manufacturer's code, either direct digit or coded series. Change keys shall also be stamped with set numbers direct digit.
c. Master keys shall be National GM2.

8. Elbow catches: Equal to Ives 2A.
9. Grommets in casework: Plastic, of the color selected by the Architect, with flip-top of appropriate size for wire management, by Doug Mockett & Co., Hardware Concepts, Inc., Wood Technology, Inc., Blanton & Moore, or Metcor Manufacturing Co.
10. Shelf standards: Knape & Vogt 255 series recessed steel pilaster standards with 256 series steel shelf supports or approved equal.
11. Wire manager: Plastic, of the color selected by the Architect, Doug Mockett & Co., Inc. WM-2A, Blanton & Moore WMC-4000 Series, or equal. Provide at each computer station.
12. Bolts: Surface type BBW No. 97-B6, Quality B6 or Trimco No. 4856-6.
13. Provide seismic restraints for open shelf supports.
14. Card Holders for Drawers: Corbin No. 1913-1/4H or Garcy No. 853.
15. Hanger Rods: 1-1/16 inches minimum diameter metal tubing, aluminum or stainless steel clad, KV660; heavy wall steel tubing KV770.
16. Hanger Rod Flanges: KV757, or flanges KV734, KV735; Ronther Reiss R44-55; or equal.
17. Casework door silencers: Provide at tops and bottoms of all doors.

K. Rough hardware:

1. Wood screws, nails and anchors: As selected by the fabricator provided that they result in permanent connections.
2. Toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete work for anchorage.

2.2 FABRICATION

A. Casework:

1. NAAWS Custom Grade.
2. Countertops: Premium Grade.
3. Exposed interior surfaces: Low pressure melamine overlay.
4. Semi-exposed surfaces: Cabinet liner.
5. Doors, drawer fronts, and false fronts: Flush overlay.

a. Edgeband at doors, drawer fronts, and false fronts: 3mm PVC.

B. Drawers: Comply with the requirements of the NAAWS for the Grade specified.
C. Countertops: See Section 12 36 61 Quartz Surfacing.

1. Back splashes: As detailed, see Section 12 36 61.
2. Front edges: As detailed, see Section 12 36 61.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the adequacy and proper location of any required backing or support framing.
B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this Section are in place and ready.
C. Examine conditions and measurements affecting the work of this Section at site.
D. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

3.3 INSTALLATION GENERAL

A. Comply with requirements of WI, and Code for seismic attachment and bracing.
B. Install work plumb, level, true and straight with no distortions, to a tolerance of 1/8-inch in 8 feet from plumb and level.
C. Shim using concealed shims.
D. Scribe and cut work to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
E. At gypsum board construction, anchor through wall surface to backing plates and studs. Indicate location of required concealed backing on casework shop drawings.
F. Furnish fillers, closures and trim as required for a complete installation. Scribe in place where required.

3.4 CASEWORK

A. Comply with WI's Architectural Woodwork Standards for custom installation unless otherwise detailed.
B. Install in a manner consistent with the specified quality grade, plumb, level, true and straight with no distortions.
C. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
D. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
E. Secure to ground, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a satisfactory installation. Scribe and cut for accurate fit to adjacent finished surfaces.

3.5 COUNTERTOPS

A. Comply with WI's Architectural Woodwork Standards for custom installation unless otherwise detailed.
B. Anchor securely to base units and other support systems as indicated. Fasten joints in tops with draw-bolt type fasteners let into underside of top.
C. Install countertops with ends as detailed.
D. Verify opening requirements and make cutouts for sinks, fittings, service fixtures, and equipment.
E. Scribe laminated plastic tops to walls and other adjacent items.
F. Fill gaps between solid surface tops and walls and other adjacent items with color matched sealant.

3.6 FIELD QUALITY CONTROL

A. Field touchup shall be the responsibility of the installer and shall include filling in of nail holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleanup of the finished surfaces.
B. Protecting:

1. Do not use the top of casework for storage.
2. Do not store materials adjacent to woodwork unless it is protected against damage and staining.
3. When painting or touching-up surfaces contiguous to woodwork, mask it with non-staining Kraft paper and tape.

C. Replace work damaged beyond satisfactory field repair, as determined by the Architect, with satisfactory millwork.
D. Before inspection for Substantial Completion, remove protective covering and clean interior and exterior surfaces using procedures and materials recommended by manufacturer.

END OF SECTION

DIVISION 07

THERMAL & MOISTURE PROTECTION

SECTION 07 14 16 – COLD FLUID-APPLIED WATERPROOFING SYSTEMS

1.1 SUMMARY

A. Section includes cold fluid-applied waterproofing membrane system as follows:

1. Interior face of planters.
2. Cistern waterproofing for fire-suppression water.
3. Over plywood substrate under concrete paving at elevated walkways.
4. Additional miscellaneous materials required to provide complete and waterproof assemblies.

B. Related Requirements: See Division 07 for waterproofing quality assurance.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing: The installation shall proceed in the following sequence with no intervening delays exposing the membrane to UV and physical and chemical damage from other construction activities (a) Membrane application, (b) flood testing, (c) protection board. Do not leave waterproofing exposed to the elements longer than recommended by its manufacturer.

B. Pre-installation meeting:

1. Prior to start of installation, arrange a pre-installation meeting between the waterproofing manufacturer authorized representative, the Contractor, the installer, and the Architect to review conditions of surfaces to be waterproofed, as well as other conditions that would affect the quality of this work, the Drawings and Specifications, and the waterproofing manufacturer's data.
2. Review all typical and atypical details to verify the method of waterproofing system installation and flashing requirements that the Contractor will follow, as well as corrective actions that are required.
3. Identify, review and discuss special conditions not specifically referenced or addressed by the Project Drawings, manufacturer's typical details, or the Shop Drawings.
4. Take photographs and notes of unresolved conditions, if any, along with sketches of the same unresolved conditions so that a determination can be made of actions to be taken to assure an installation that will be acceptable, watertight and acceptable to the waterproofing material manufacturer for issuance of the warranty.
5. Record meeting minutes and distribute copy in PDF format to all concerned, and the Architect, within 48 hours after the meeting.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data supplemented by detailed drawings showing flashings of penetrations, treatment of cracks in substrate, reinforcement of changes in direction, and other pertinent details.

B. Shop Drawings:

1. Indicate flashing conditions at penetrations, corners and other points of stress, and terminations of the waterproofing membrane.
2. Detail and identify bridging materials between different waterproofing systems.

C. Samples: 12-inch square Samples of membrane and protection board.

D. Letter of acceptance: Before proceeding with application, submit letter from the manufacturer to verify acceptance of applicator, and the substrates as satisfactory to receive this work.

E. Warranty: Sample copies of warranties for assemblies to be furnished under this Section, clearly defining terms, conditions, and time periods for the warranty.

F. Manufacturer field reports: Reports of field observations, supplemental instructions issued and corrections made during installation.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Qualified firm authorized, approved, or licensed to install products specified and eligible to receive warranty specified, with at least 3 years experience in work of the type required by this Section.
B. Manufacturer’s inspections:

1. Request the manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.
2. Unsatisfactory conditions disclosed by the manufacturer visits to the site shall be promptly and satisfactorily repaired and the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

1.5 HANDLING

A. Handling: Handle products to avoid damage to container and contamination.
B. Storage: Do not store for long periods in direct sunlight.

1.6 JOB CONDITIONS

A. Environmental requirements:

1. Do not proceed with application of materials when deck temperature is less than 40-degree F.
2. Do not apply materials unless surface to receive waterproofing is clean and dry.
3. Do not apply waterproofing when precipitation is imminent and during rainy weather.
4. Provide positive ventilation in areas not subject to natural ventilation, throughout the application and drying periods.

B. Protection: Protect flora and adjacent surfaces from overspray. Use drop cloths and masking as required.

1.7 WARRANTY

A. Warrant the waterproofing against defective materials and workmanship for 30 years after Substantial Completion.
B. Include removal and replacement of materials concealing waterproofing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/SYSTEMS

A. General compatibility: Provide materials recommended by manufacturer to be fully compatible with indicated substrates, including modification by additives.
B. Waterproofing membrane: One of the following bitumen-free urethane membrane.

1. Basis of Design: Gaco Western, Inc. “LM-60”.
2. Tremco “Tremproof 201/222.”
3. Tremco “Tremproof 250 GC.”
4. Carlisle Coatings & Waterproofing “Miraseal.”
5. Neogard Corp. “Perma-Gard.”

2.2 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water thru waterproofed surfaces.
B. Provide materials recommended by manufacturer to be fully compatible with indicated substrates, including modification by additives.

2.3 MISCELLANEOUS MATERIALS

A. Drainage board: VeriCell Water Drainage System by Tournesol Siteworks of Hayward CA. Wrap VeriCell in filter fabric prior to installation.
B. Root barrier; “Root Stop,” high-density polyethylene (HDPE) geo-membrane produced from specially formulated, virgin polyethylene resin by Hydrotech or equal.
C. All other materials: As recommended by the membrane manufacturer for the conditions of use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Supervise the work of the concrete finisher to obtain finished concrete surfaces complying with the waterproofing manufacturer's printed instructions.
B. Examine surfaces to be waterproofed for conditions that would adversely affect execution, permanence and quality of work of this Section.
C. Verify a 2 percent slope on plywood substrate walkways to receive this system.
D. Correct detrimental conditions before proceeding with installation.

3.2 SUBSTRATE PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with manufacturer’s instructions.
B. Install cant strips and similar accessories as shown and as recommended by manufacturer even though not shown.
C. Fill voids, seal joints, and apply bond breakers as recommended by manufacturer.
D. Prime substrate as recommended by manufacturer.
E. Mask off adjoining surfaces not to receive fluid-applied waterproofing to effectively prevent spillage or overspray of liquid materials outside membrane area.

3.3 PREPARATION/APPLICATION

A. Prepare substrate and apply waterproofing membrane in compliance with ASTM C 898 and the waterproofing manufacturer's instructions to an average thickness of 90 mils DFT .
B. Allow membrane to cure under conditions that will not contaminate or deteriorate waterproofing material. Block off traffic and protect membrane from physical damage.
C. The completed installation shall be watertight, free of holidays, uniform in thickness, and seamless.
D. When installing the protection board, allow to relax and cut to size. Install for a tight fit and hot-air weld all laps and seams. Install 29-inch wide layer of root control system around all drain openings under the protection board to prevent invasive root growth and to provide drainage between protection board and waterproofing membrane.
E. Install drainage/protection board at planters on cured membrane without delay, after testing to minimize membrane exposure.

    1. After the waterproofing membrane is inspected and deficiencies repaired, cover membrane with drainage panels.

2. Start at the low point of the wall and attach the panel to the wall. Connect the panels to the foundation drain for uninterrupted water flow to the perimeter drain and the storm drain system.
3. Join adjacent panels with the lateral edge of the connecting panel placed over the flanged edge of the previous panel, or by nesting the dimples; the fabric from the adjacent panels shall overlap the preceding panel and be adhered with adhesive or duct tape.
4. Seal top or terminal edge of the drainage panel by wrapping the extra filter fabric around to the back side of the panel, to prevent soil or other foreign construction materials from intruding into or behind the panels.
5. At planters, extend membrane to top of vertical face to minimize efflorescence on exterior face.
6. Attach drainage panel with contact adhesive or tape in accordance with the panel manufacturer's instructions.
7. Backfill as soon as possible after inspection to at least 6 inches above the top edge of the drainage panel.

3.4 FIELD QUALITY CONTROL

A. Thickness:

1. Verify the thickness of the waterproofing during application by measurements (every 20 square-foot minimum), taken with a wet film gage.
2. Inspect surfaces coated to insure that no areas have been missed. Repair missed areas and holidays in the membrane.

B. Water test:

1. After completing installation of waterproofing, and just prior to installation of wearing surface over membrane, plug drains and other outlets, dam areas that cannot be otherwise partitioned, and test membrane in compliance with ASTM D 5957.
2. Repair leaks where they occur, and retest the membrane until proven watertight.
3. When area is proven watertight, drain water and remove dam.

3.5 CLEANING

A. Remove bituminous and other markings from finished surfaces.
B. Where finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.6 PROTECTING

A. Use caution to avoid damaging the membrane. If portion of waterproofing membrane becomes damaged, repair immediately.
B. After completing application, do not allow traffic on coated surfaces until the waterproofing has cured and the protection boards are in place.
C. Protect waterproofing as necessary until wearing surfaces are installed.

END OF SECTION

SECTION 07 21 00 - THERMAL BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes thermal insulation at locations specified below in and the following:

1. Safing insulation at edges of slabs and elsewhere as indicated.
2. Thermal insulation (board form) on the exterior face of exterior walls.
3. Thermal insulation (batts) between studs in exterior walls.
4. Thermal insulation (batts) in soffits where indicated.

B. Insulation location: As a minimum, provide thermal insulation for the building envelope, as defined below

1. Building envelope (all exterior walls but excluding roof insulation specified elsewhere, at parapets and openings in walls, including louvers (where no blank-off panels occur), vision glass and doors).
2. Exterior soffits of air-conditioned spaces.

C. Perimeter fire-containment systems: Where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UL 2079 or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Related requirements:

1. Division 03 & 07 for roof insulation.
2. Division 09 for acoustical insulation.
3. Division 22 for pipe and duct insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Sequence and coordinate application of insulation with related work to comply with the following.

1. Provide temporary enclosures to prevent deterioration of insulation exposed to unfavorable environmental conditions.
2. After its application, avoid unnecessary exposure of insulation to damage during construction operations.
3. Do not begin application of insulation under steel deck until clips, hangers, supports, sleeves, and other items penetrating insulation are in place.
4. Defer installing ducts, piping, and other items that would interfere with the application of insulation until insulation installation is completed.
5. Do not install enclosing or concealing construction until after insulation is installed, inspected, tested, and corrections are made to provide an uninterrupted thermal barrier.

B. Pre-installation meeting:

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for materials specified.
B. Shop Drawings:

1. Show each type of insulation, indicating type and manufacturer, location, extent, material, insulating value, and method of attachment.
2. Submit color-coded floor plans supplemented by elevations showing the location of each type of insulation. Identify material, manufacturer, thickness, R value, and method of fastening where applicable.

C. Samples:

1. 24 inches square Samples of each type of insulation.
2. Full size impaling pins.
3. Twelve inches long Samples of tape.

1.4 HANDLING

A. Packaging: In unopened containers and packages with labels bearing producer(s) name and source of product, date of manufacture, with UL classification on package, and R value.
B. Storage:

1. Keep insulation protected while stored; keep dry during and after installation.
2. Outdoors, store off ground on pallets, protected with breathing type covers.
3. Insulation shall be dry when installed.
4. Remove insulation that becomes wet or damp immediately from the job site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Install insulation in dry weather, unless building is enclosed and watertight.
B. If insulation will be exposed to the elements after installation, cover with waterproof membrane each day; do not enclose wet insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fiber glass batt insulation: One of the following, or equal.

1. Owens Corning.
2. CertainTeed.
3. Knauf Insulation.
4. Johns Manville.

B. Mineral wool insulation: One of the following, or equal.

1. Thermafiber (basis of design).
2. Rockwool Group.
3. Partek Insulations, Inc.
4. Rock Wool Manufacturing Co.
5. Fibrex Insulation, Inc.
6. Industrial Insulation Group, LLC.

C. Polyiso board insulation for use on above grade walls: One of the following Non-ODP, Low GWP and formaldehyde-free, complying with ASTM C578, Type XV..

1. Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2, Grade 2 (20 psi).

a. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2. Manufacturers:

a. Enverge CI foil faced by Firestone.
b. Hunter Xci CG by Hunter Panels
c. EnergyShield CGF Pro by Atlas.

D. Polystyrene board insulation for use on below grade walls: One of the following.

1. Foamular 150 by Owens Corning
2. ThermaDRain Insulated Drainage Board.
3. Insulfoam a Carlisle Co.
4. Or equal rigid insulation that also serve as a protection/drainage board.

2.2 PERFORMANCE/DESIGN CRITERIA

A. Some exterior envelope elements are based on the "Rain Screen Principle". This requires construction behind cladding to act as an air/water barrier to prevent passage of moisture laden air and diffusion of water vapor inside the building. To ensure continuity of air/waterr barrier within construction specified herein and with adjacent barrier construction is a responsibility of this Section.
B. Comply with these Specifications for thermal resistance, and to the Drawings for maximum or minimum thickness of insulation required.

1. Provide the thermal resistance (R value) indicated to limit building thermal gains and losses.
2. Select appropriate products from list of materials to provide (a) the specified thermal value for the building envelope, (b) compatibility when incorporated into finished system while ensuring substrate conditions as well as their ability to adhere components permanently, where applicable, in rigid manner, and (c) maintain flexibility where required in finished work.
3. Provide insulation materials and their facings that do not support fungal growth when tested in accordance with ASTM C1338.

2.3 THERMAL INSULATION

A. Thermal resistance (“R” value): Minimum of 19, except as noted.
B. In curtain wall:

1. Mineral fiber complying with ASTM C 612; non-combustible when tested in compliance with ASTM E 136, fire resistant when tested in compliance with ASTM E 84 and E 119, 8 pcf, dark gray color, foil-faced.
2. Fire hazard classification:

a. Flame spread: 25 maximum.
b. Fuel contributed: 5.
c. Smoke developed: 5.

3. Acceptable product: Thermafiber “FSP Curtainwall Insulation,” “FBX Curtain Wall Insulation” by Fibrex, “Pyro-Fiber Curtain Wall Insulation” by Johns-Manville, or “Paroc CW” by Partek Insulations, Inc.

C. Under floor slabs-on-grade: Extruded-polystyrene drainage panels, ASTM C 578 (Type VI) with a compressive strength of 40 psi, “Styrofoam Highload 40” by Dow Chemical Co. or Owens Corning “Foamular 400.”

D. On soffits exposed to view (not concealed by a suspended ceiling): CertaPro Commercial Board by CertainTeed Corp. with a white kraft-scrim-foil (ASJ) facing adhered to the fiber glass board.

E. Sprayed foam sealant: Fire-rated polyurethane foam insulation meeting ASTM E 84, one- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 pcf density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

1. Dow.
2. Tiger Foam Insulation.
3. Fomo Products, Inc., or equal.

F. Mineral wool semi-rigid (board) insulation: Thermafiber “RainBarrier 30 or 45,” semi-rigid boards, water-repellent, or equal with the following characteristics:

1. ASTM C 665 Non-corrosive, Type I, III.
2. ASTM C 612 RainBarrier 30 Type IA.
3. ASTM C 612 RainBarrier 45 Type IA, IB, IVA.
4. ASTM E 136 Rated Non-combustible per NFPA Standard 220.
5. ASTM E 96 Unfaced, 50 Perms as tested.
6. ASTM E 84 Flame Spread 0, Smoke Developed 0.
7. ASTM C 1104 Absorbs 0.03% by volume.
8. ASTM C 356 Linear Shrinkage <2% 1200º F.

G. At all other locations:

1. Type: Glass fiber or mineral wool batt or blanket insulation complying with ASTM C 665, Type III, Class A, flame spread (FSK) 25 or less, formaldehyde-free by Johns Manville, Knauf, or equal.
2. Width: Batt width shall match the stud spacing and be sized for a friction-fit to be self-supporting.

2.4 INSTALLATION MATERIALS

A. Impaling pins and clips: Cemco 1500 Series, Tactoo Insul-Hangers Series T by AGM Industries, Inc. or equal by Eckel Industries, Inc., of appropriate length required for insulation thickness used.

B. Clips at slab perimeter: 22-gage galvanized steel closure angle at underside of slabs if gap is larger than 4 inches from slab edge to mineral wool insulation plane.

C. Strip impalement clips at slab perimeter: Thermafiber “Insulation Hangers,” or equal acceptable to AHJ, fabricated from galvanized sheet in rolls with punch out insulation securement arrows.

D. Insulation supports for between rafters insulation: 13-gage steel, IS16 and IS24 (depending on wood framing spacing) by Silver Metal Products, Inc., Southeastern Wire, Moore Products, or equal.

E. Adhesive used with impaling pins: Made, or approved by the clip manufacturer. Do not use "peel and press" hangers with self-adhesive back.

1. Where insulation is installed under concrete-filled steel deck, "Drop/Deck Nails" of the required length by Cemco may be used through the steel deck before concrete fill is cast.

F. Staples, zinc-coated wires and other devices for fastening insulation: As recommended by the insulation manufacturer.

G. Insulation tape:

1. Polyethylene Adhesive Tape: “Scotch brand No. 483” by 3M.
2. Foil Vapor Barrier Tape:

    a. Pressure sensitive aluminum foil tape, 2 mils thick, 3-inch wide, “Scotch brand No. 425" by 3M.
    b. “Dead Soft Aluminum Foil Tape” by Hanson Ltd.
    c. “FSK Copolymer” by Compac Corp.
    d. “General Purpose FSK Facing Tape” by Venture Tape.
    e. Or equal FSK-faced cold weather tape.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.
C. Before installing insulation in stud walls, thoroughly vacuum space clean of dust and debris. Also clean spandrel cavities in the same manner.

3.2 INSTALLATION

A. Install insulation where shown and specified. Cut to fit irregular spaces, butt edges into firm contact with each other and adjoining surfaces.

    1. Hand pack around pipes, ducts, conduits, electrical boxes, and other penetrations as required to thoroughly fill all voids and spaces between framing members and to form a continuous fire, thermal barrier.
    2. Do not compress insulation more than 10 percent.
    3. Where door and window frames occur in insulated assemblies, cut additional strips of insulation and hand-pack in and around the frames or use foam insulation to fill all voids.
    4. Insulate boxed headers and studs in exterior walls.
    5. Use foam insulation for small spaces that are difficult to insulate otherwise. Fill space completely and trim insulation flush with face of wall when cured.
    6. Comply with the National Electrical Code (NEC) for installation in proximity to light fixtures. Do not install insulation closer than recommended by NEC.
    7. Where in-wall electrical conduit is parallel to the wall, slit the insulation halfway to bury the conduit in it. Where the conduit is perpendicular to the wall, do not oversize the penetration; tape the conduit to prevent heat leakage.
    8. Install foil-faced insulation with foil facing the building interior.

B. Batt insulation in stud walls:

    1. Install wall insulation with aluminum foil facing interior of the building, with a friction fit to studs, short joints closely butted, and with joints square, straight without warp or twist.
    2. Cut and fit insulation to closely fit intersecting or penetrating surfaces.
    3. Leave no voids in completed installation.
    4. Provide insulation to meet the overall thermal resistance requirements of the exterior wall enclosure.

C. Rigid insulation – under radiant floor heating system:

    1. Where more than one layer of insulation is required to achieve the thermal resistance specified, apply adhesive in ribbons 6 inches apart to insulation in accordance with the adhesive manufacturer’s instructions so when in place, the boards are firmly adhered to

each other. Adhere the bottom boards to a clean, dry substrate in the same manner. Stagger joints between boards.

2. Protect board until the radiant system is installed and has been successfully tested. Prohibit non-essential foot traffic from exposed boards.

D. Attach insulation to solid surfaces as follows:

1. Where required, install insulation fasteners before fireproofing.
2. Provide insulation fasteners at typical spacing specified, or equivalent area for panels of a different size and for any cut panel sizes, except not less than 2 fasteners for any single piece.
3. Lay out panels for minimum of joints, and with any single piece not less than 24 inches wide or less than 48 inches long, unless otherwise approved.
4. Offset intermediate end joints in adjacent panels not less than 48 inches.
5. For 48-inch wide units follow insulation manufacturer's instructions. Provide a minimum of 8 fasteners. Space edge fasteners no more than 3-inch from edges.
6. For 24-inch wide units, comply with the above, except use no less than 6 fasteners.
7. Secure each metal clip base in full bed of adhesive as recommended by their manufacturer.
8. Do not install panels until clip adhesive is fully set.
9. Cut panels in straight lines using tools which minimize fraying. Neatly and carefully precut small slots through panels to facilitate placing insulation over fasteners.
10. Install panels fully bearing against substrates, and neatly and tightly fitted at joints and around surfaces of penetrations.
11. Install fastener caps firmly against panel faces and without compressing insulation, and turn clip prongs or steps flat against caps.

E. Between rafters, support insulation with insulation supports spaced at 16 inches o.c. maximum.

F. After installation is complete and before concealing, seal joints between insulation, between insulation and intersecting or penetrating surfaces and between insulation and perimeter surfaces with 4-inch wide vapor-proof aluminum colored tape applied on the aluminum foil facing side. Seal fastener punctures with aluminum colored vapor-proof mastic or use tape used for sealing joints.

G. Cut safing insulation slightly oversized and compress in the space to be fireproofed so that no void remains. At edge of slabs, impale securely on metal clips spaced at 12 inches o.c. maximum, and attach the clips securely to the slab**.**

3.3 FIELD QUALITY CONTROL

A. Prior to closing-in of insulated assemblies, or prior to Substantial Completion for insulation that will remain exposed in the building, refit, reinstall and/or replace wet, damaged and displaced insulation.

END OF SECTION

SECTION 07 26 16 - BELOW GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aggregate bed and vapor retarder (VR) under building concrete slabs-on-grade.
B. Related requirements:

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing: Schedule and sequence installation of VR so it will stay exposed to construction traffic for as short a time as possible to avoid damage.

1.3 SUBMITTALS

A. Data:

1. Manufacturer Product Data, specifications, typical installation details and other data necessary to demonstrate vapor retarder compliance with the specified requirements.
2. Summary of test results, ASTM E 1745.

B. Samples: 24-inch square Samples of vapor retarder with a taped joint at third point.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vapor retarder: By Reef Industries, Inc., or equal by one of the following complying with ASTM E 1745 Class A, and the values given below.

1. Fortifiber Corp.
2. WR Meadows.
3. Raven Industries.
4. Stego Industries, LLC.
5. Or equal.

2.2 PERFORMANCE REQUIREMENTS

A. Vapor retarder:

1. Material: 7-ply laminate, combining 4 layers of high-density polyethylene and 3 high-strength non-woven cord grid.
2. Weight: 82 lb/1,000 square feet when tested in accordance with ASTM D 3776.
3. Puncture propagation Tear: 55 lb when tested in accordance with ASTM D 2582.
4. Permeance (Perm): 0.019 grains/hr-sq ft-in Hg when tested in accordance with ASTM E 96.
5. Drop dart: 2300 g, when tested in accordance with ASTM D 1709.
6. Tensile strength: 275 lb/5,464 psi when tested in accordance with ASTM D 882, 3-inch-wide specimen.
7. Puncture strength: 72 lb when tested in accordance with ASTM D 4833.
8. Classification: Class A, when tested in accordance with ASTM E 1745.

9. Usable temperature range: Minus 45 to 170 degrees F.

2.3 MATERIALS

A. Vapor retarder: “Griffolyn Type 105”
B. Sealing material: Mastic, adhesive or pressure-sensitive adhesive tape recommended by the vapor retarder manufacturer.

1. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Repair tape: Self-adhesive tape recommended by vapor retarder manufacturer to repair holes in membrane by jobsite activities.

1. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Pipe boots: Of sizes indicated, compatible with vapor retarder and adhesive materials.

E. Stone aggregates (base course): Washed, evenly graded mixture of gravel conforming to the following gradation.

Sieve size	Percent passing
3/4-inch	90 to 100
No. 4	0 to 10
No. 100	0 to 3

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions affecting the work of this Section at the site.
B. Verify below-grade work and items penetrating moisture retarder are complete.
C. Verify that subgrade is level and compacted to 95 percent maximum density, determined in compliance with ASTM D 1557.
D. Correct detrimental conditions before proceeding with installation.

3.2 AGGREGATE BEDDING

A. Cover subgrade with a minimum 4-inch layer of stone aggregate.
B. Work to fill voids; vibrate to compact and leave with finished surfaces reasonably uniform at established grade.

3.3 VAPOR RETARDER

A. Cover aggregate bed with the vapor retarder.
B. Comply with ASTM E 1643 and the following:

1. Layout to minimize running and side joints with long dimension parallel with the direction of the pour.
2. Spread sheeting over undamaged vapor retarder, smooth and even; lap edge and end joints 6 inches; turn-up perimeters against concrete walls/footings to top of future slab and tape continuously to clean, dry concrete so that neither the tape nor the vapor barrier is visible when the slab is cast.

3. Offset intermediate end joints in adjacent sheets 4 feet minimum.
4. Seal laps and perimeters using continuous beads or strips of sealing material applied to bottom layer or tape. When using sealing material, apply top layer and press sufficiently to assure complete contact.

C. Penetrations:

1. Cut sheeting to fit closely and neatly.
2. Slip sheeting over penetrations where possible, otherwise slit from penetration hole to nearest edge.
3. Seal pipe penetrations with prefabricated boots made from vapor retarder and seal tight with tape to the vapor retarder.
4. Seal edges continuously around penetrations.
5. For smaller penetrations, repair slits with 12-inch wide strips of sheeting set centered on slit and sealed on each side.

D. Cuts and accidental tears: Repair with tape, or if too large, with patches of the vapor retarder continuously taped.

END OF SECTION

SECTION 07 27 26 - FLUID-APPLIED AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this Section includes window and door flashing, air and water-resistive barrier membrane system, and accessory materials for application to exterior building envelope, except where doors and windows occur.

B. Related requirements:

1. Section 03 30 00 – Cast-in Place Concrete.
2. Section 06 16 00 – Gypsum Board Sheathing.
3. Section 07 60 00 – Flashing and Sheet Metalwork.
4. Section 07 92 00 – Joint Sealers.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation conference: Prior to beginning installation of air and water-resistive barrier system, hold a pre-installation conference to review work to be accomplished.

1. Contractor, Architect, installer, membrane system manufacturer's representative, and other trades who have materials penetrating membrane system or finishes covering membrane system shall be present.
2. Contractor shall notify participants at least 7 days prior to time for conference.
3. Contractor shall record minutes of meeting and distribute to attending parties.
4. Agenda: As a minimum discuss the following.

    a. Surface preparation.
    b. Substrate condition and pretreatment.
    c. Minimum curing period.
    d. Special details and sheet flashing.
    e. Sequence of construction, responsibilities, and schedule for subsequent operations.
    f. Installation procedures.
    g. Inspection procedures.
    h. Protection and repair procedures.
    i. Review and approval of all glazing applications.

1.3 SUBMITTALS

A. Data: Manufacturer’s Product Data including membrane and accessory material types, technical and test data, composition, descriptions and properties, installation instructions and substrate preparation requirements.

B. Shop Drawings: Provide manufacturer’s Installation Guideline Illustrations.

C. ASTM E 2357 Compliance: If applicable, submit certification from an approved independent testing laboratory as well as the Air Barrier Association of America (ABAA).

1.4 QUALITY ASSURANCE:

A. Manufacturer qualifications: Firm with a minimum of 5 years experience in the production and sales of air and water-resistive barrier system.
B. Installer qualifications: The installer shall demonstrate qualifications to perform the work of this section by submitting the following.

1. Verification that installer has been trained by and is approved to perform work specified by the air and water-resistive barrier system manufacturer.
2. Firm experienced in applying similar materials on projects of similar size and complexity.
3. Evidence of proper equipment and trained field personnel to successfully complete the Project.

C. Inspection and testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover installed products or assemblies until they have been inspected, tested and approved.
D. Sole source: Obtain materials from a single manufacturer.
E. Regulations: Provide products which comply with state and local regulations controlling use of volatile organic compounds (VOC).
F. Sourcing: Components used shall be sourced from one manufacturer, including sheet membrane, water- resistive vapor permeable air barrier sealants, primers, mastics, and adhesives.

1.5 HANDLING:

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
B. Protect air and water-resistive barrier components from freezing and extreme heat. Store materials at temperatures of 40 degrees Fahrenheit to 100 degrees Fahrenheit.
C. Sequence deliveries to avoid delays, and to minimize on-site storage.

1.6 PROJECT CONDITIONS:

A. Weather conditions: Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.

1. Apply at surface and ambient temperatures recommended by the manufacturer.
2. Proceed with installation only when the substrate construction and preparation work are complete and in condition to receive the membrane system.

B. Exposure limitations: Schedule work to ensure that air and water-resistive barrier system is covered and protected from UV exposure within 180 days of installation. If air and water-resistive barrier membrane system cannot be covered within 180 days after installation, apply temporary UV protection as recommended by membrane manufacturer.

1.7 WARRANTY

A. Manufacturer's warranty requirements: Submit manufacturer's written warranty stating that installed air and water-resistive barrier materials are watertight, free from defects in material and workmanship, and agreeing to replace defective materials and components.
B. Warranty period: 5 years from Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance requirements: Comply with the specified performance requirements and characteristics specified.
B. Performance description:

1. Elastomeric, acrylic, water-resistive vapor permeable air barrier membrane system shall be constructed to perform as a continuous air barrier, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration.
2. Membrane system shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air sealant materials at such locations, changes in substrate, perimeter conditions and penetrations.
3. Joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
4. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
5. System shall be installed in an airtight and flexible manner, allowing for relative movement of substrate due to building movement caused by wind, thermal and moisture variations.

C. Intent is to bridge and seal the following air leakage pathways and gaps:

1. Connections of the walls to the roof air barrier.
2. Connections of the walls to the foundations.
3. Seismic and expansion joints.
4. Openings and penetrations of window and door frames, store front, curtain wall.
5. Piping, conduit, duct and similar penetrations.
6. Masonry ties, screws, bolts and similar penetrations.
7. All other air leakage pathways in the building envelope.

D. Water-resistive vapor permeable air barrier membrane system to be applied to the minimum uniform thickness specified and as utilized in the referenced Standard Test Methods.

2.2 MANUFACTURER:

A. Basis-of-Design Manufacturer: Sika Corporation, 201 Polito Avenue, Lyndhurst NJ 07071. Toll Free 800-933-SIKA (7452), www.sikausa.com or equal.

2.3 FLUID-APPLIED MEMBRANE AIR BARRIERS

A. Air Barrier Membrane: Sikagard® 540 Liquid Applied Acrylic Vapor Permeable Air Barrier by Sika Corp, a low VOC one component elastomeric acrylic membrane that may be trowel, brush, roller or spray applied. Membrane shall have the following physical properties:

1. Color: Yellow.
2. Air permeability: less than 0.004 CFM/ft2 @ 1.57 lbs/ft2 to ASTM E 2178, passes ABAA.
3. Tested to ASTM E 2357 for Air Leakage of Air Barrier Assemblies, passes ABAA.
4. Water vapor permeance (21 mil dry thickness): 11 perms to ASTM E 96 Method B.
5. Nominal wet film thickness: 40 mils.
6. Recycled Content by weight: 25%.
7. VOC: <50g/l.
8. Fastener Sealability: Pass to ASTM D 1970.
9. Water Resistance: Pass to AATCC 127.
10. Exposure: May be exposed for up to 6 months
11. Fire Performance: Flamespread Index of 20, Smoke Developed Index of 25 and Class A rating per ASTM E 84.

2.4 SELF-ADHERING MEMBRANE SEAM TAPE

A. Self-Adhering Membrane Seam Tape: SikaMultiSeal® 540 Self-Adhered Transition Seam Tape by Sika Corp, a self-adhering polyester-backed, synthetic butyl rubber based adhesive membrane for wall construction, specifically designed to be water resistant. Use for all window jambs, headers, door openings, inside and outside corners, joint treatment and other transitions shall be Membrane shall have the following physical properties:

1. Membrane Thickness: 0.0394 inches (40 mils).
2. Low temperature flexibility: -30 degrees F.
3. Elongation: 500% to ASTM D 412-modifed.

2.5 LIQUID SEAM AND PENETRATION SEALANTS

A. Liquid Seam Sealant: Sikaflex® 11FC by Sika Corp, a polyurethane, elastomeric sealing compound having the following physical properties:

1. Compatible with air barrier, roofing and waterproofing membranes and substrate.
2. Set Time: 1 hour @ 72 degrees, 40% RH.
3. VOC < 50 g/l.
4. Elongation:600% to ASTM D 412.
5. Joint Movement 12.5%+/- ASTM C 719.
6. Seals construction joints.

B. Penetration Sealant: Sikaflex® 11FC by Sika Corp, a polyurethane, elastomeric sealing compound having the following physical properties (other Sikaflex sealants may apply):

1. Compatible with air barrier, roofing and waterproofing membranes and substrate.
2. Set Time: 1 hour @ 72 degrees, 40% RH.
3. VOC < 50 g/l.
4. Elongation:600% to ASTM D 412.
5. Joint Movement 12.5%+/- ASTM C 719.
6. Seals construction joints.

2.6 PRIMER AND SURFACE CONDITIONER

A. Primer: Sikagard 510® Transition Seam Tape Primer for self-adhering transition and flashing membrane at all temperatures, a high tack adhesive primer, quick setting having the following physical properties:

1. Color: White,
2. Solids by weight: 37%,
3. Drying time (initial set): 30 minutes.

B. Surface Conditioner: Sikagard® 540 Liquid Air Barrier Membrane for self-adhering transition and flashing membrane at temperatures above 40 degrees F, having the following physical properties:

1. Color: Yellow.
2. Solids by weight: 64%,
3. Application Rate: 160 sq.ft/gallon to a uniform wet film thickness of 10 mils.
4. Drying time (initial set): 60 minutes.

2.7 SELF-ADHERED THRU WALL FLASHING

A. Self-Adhering Thru-Wall Flashing: Sika® MultiSeal® Plus by Sika Corporation, an ethylene propylene copolymer adhesive with a UV resistant TPO membrane facer for cavity wall construction. Specifically designed to be water resistant and used as a thru-wall flashing membrane:

1. Thickness (Membrane): 0.032 inches (32 mils).
2. Elongation (ASTM D412): 600%.
3. Membrane Tensile Strength (ASTM D412): 3500 PSI.
4. Measured Flow (ASTM D5147): PASS.
5. Low Temperature Flexibility -22F (CGSB 37-GP-56M): PASS.
6. Water Vapor Permance (ASTM E96): Impermeable.
7. Adhesion to Concrete (ASTM D903): 6.0 lbf/in.
8. Adhesion to DensGlass Gold (ASTM D903): 6.0 lbf/in.
9. Moisture Absorption (ASTM D570): PASS (<1g absorption).

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify that surfaces and conditions are ready to accept the Work of this section. Correct discrepancies.
B. Substrates to receive the work of this Section must be sound, dry, clean, and free of grease, dirt, excess mortar or other contaminants. Fill voids, gaps, and spalled areas in substrate to create an even plane. Fill masonry head joints fully and tool.
C. Where curing materials are used they must be clear resin based without oil, wax or pigments.
D. Condition materials to room temperature prior to application to facilitate extrusion and handling.

E. Do not proceed with application of air barrier membrane when rain is expected within 24 hours.

F. Condition materials to ambient temperature prior to application to facilitate handling.

3.2 SURFACE PREPARATION

A. Ensure preparatory Work is complete prior to applying primary air barrier membrane.

B. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

C. Mechanical penetrations such piping, conduit and vents shall be secured solid and fastened into solid backing.

3.3 INSTALLATION

A. Joint Treatment: Seal joints 1/4 inch and less between panels of sheathing (exterior grade gypsum, faced gypsum sheathing, plywood, OSB or cementitious panels) with liquid seam sealant. Fill joint between sheathing with approved liquid seam sealant ensuring contact with all edges of sheathing board.

B. Gaps and Voids: Seal gaps and voids or irregular joints greater than 1/4 inch between panels of exterior grade gypsum, faced gypsum sheathing, plywood, OSB or cementitious panels with a strip of self-adhering transition membrane lapped a minimum of 3 inches on both sides of the joint. Prepare and prime surfaces as appropriate to achieve surface adhesion and allow to dry prior to placement of self-adhering transition membrane. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps.

C. Outside Corners: Seal outside corners with a strip of self-adhering transition membrane extending a minimum of 3 inches on either side of the corner detail. Prepare and prime surfaces as appropriate to achieve surface adhesion and allow to dry prior to placement of self-adhering transition membrane. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane. Roll all laps and membrane with a counter top roller to ensure seal.

D. Inside Corners: Seal inside corners with a liberal bead of seam sealant (3/8 inch x 3/8 inch).

E. Crack Treatment for Masonry and Concrete: Seal cracks 1/4 inch and less in masonry and concrete with liquid seam sealant applied over the crack. Fill joint between sheathing with approved liquid seam sealant ensuring contact with all edges of sheathing board. Seal cracks and voids in masonry and concrete greater than 1/4 inch with a strip of self- adhering transition membrane lapped a minimum of 3 inches on both sides of the joint. Prepare and/or prime surfaces as appropriate to achieve surface adhesion and allow to dry prior to placement of self-adhering transition membrane. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane. Roll all laps and membrane with a counter top roller to ensure seal.

F. Transition Areas: Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhering transition membrane

1. Prime surfaces as per manufacturers' instructions and as appropriate to achieve surface adhesion and allow to dry prior to placement of self-adhering transition membrane.
2. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.
3. Ensure minimum 2 inch overlap at all end and side laps of membrane. Roll all laps and membrane with a counter top roller to ensure seal.

G. Thru-Wall Flashing:

1. All surfaces must be dry and frost-free, as well as clean of oil, dust and excess mortar. Strike masonry joints flush.
2. Concrete surfaces must be smooth and without large voids, spalled areas or sharp protrusions. Concrete must be cured a minimum of 14 days and must be dry.
3. May be installed direct to concrete or Dens Glass Gold without the aid of primers or other surface conditioners.
4. Applications to wood require the use of a primer.
5. Verify priming requirements before the start of each project.
6. Cut the desired length, remove the release paper, position into place and apply positive pressure using a roller. Use care to avoid blisters or wrinkles.
7. Overlap all joints by 2 inches.
8. Keep flashing sheet back about 1/2 inch from outside face of wall or veneer.
9. At all laps, seams, penetrations, and along top edges of membrane apply a continuous feathered bead of sealant as termination seal. Form end dams as required with same sealant.
10. Apply under dry conditions when air and surface temperatures are above 25 degrees F.
11. Top or leading edge of flashing sheet should be sealed with a sealant to limit rainwater from migrating behind the membrane

H. Primary Air Barrier: Apply by brush, roller, spray or flat trowel a complete and continuous unbroken film of liquid vapor permeable air and rain barrier membrane.

1. For temperatures above 40 degrees F and rising, apply one component acrylic water-resistive vapor permeable air barrier membrane at a rate of 40 sq.ft/gallon to a uniform wet film thickness of 40 mils.
2. Spray apply or brush around all projections and penetrations ensuring a complete and continuous air barrier membrane.
3. Allow air barrier membrane to dry as per manufacturers recommendations prior to placement of cladding materials.
4. Subject to porosity of substrate, recommend to back roll spray applications.

3.4 APPLICATION OF PENETRATION SEALANT

A. Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the primary vapor permeable air and rain barrier membrane and around the perimeter edge of membrane terminations at window and door frames with specified penetration sealant.

B. Seal the leading edge of membrane terminations and reverse laps.

3.5 FIELD QUALITY CONTROL

A. Make notification when sections of work are complete to allow review prior to covering water-resistive vapor permeable air barrier system.

B. Cooperate with Owner’s independent testing agency, which will observe substrate and membrane installation prior to placement of cladding systems and provide written documentation of observations.

3.6 PROTECTION

A. Do not inhibit damp substrates from drying out. Drying time will vary depending on interior and exterior temperature, and interior and exterior relative humidity. Do not expose the backside of the substrate to moisture or rain.

B. Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane. Protect uncured air barrier Work against wet weather conditions for a minimum of 24 hours. Protect air barrier membrane from damage and inclement weather during the construction phase.

END OF SECTION

SECTION 07 42 13 - PREFORMED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes preformed steel wall, fascia and soffit panels, their support system, special shapes, and all other panels elements for the building.

B. Related requirements:

1. Section 05 12 00 for steel framing supporting panels.

1.2 SYSTEM DESCRIPTION

A. General: Single-skin exposed fastener metal perforated wall panel applied as the exterior wall component.

1.3 SUBMITTALS

A. Shop Drawings: Dimensioned Shop Drawings for the panel systems, including design and detailing of panel support framing elements and their attachment to the structural frame. Coordinate Drawings and their submittal with other adjacent exterior wall components.

1. Show in detail the panel layout on each plane, support framing system, panel attachment members, jointing, dimensions, sizes and locations of cut-outs, relation to work of other trades, and other pertinent data and information.
2. Indicate and dimension adjoining, abutting and penetrating work, to be performed by other trades.
3. Number each panel to correspond to the markings shown on the fabrication/shop drawings. Mark the identification number on the back of each panel.
4. The shop drawings and calculations shall bear the seal of a California-registered professional engineer. The engineer shall also perform and submit structural calculations to document all panel conditions.

B. Samples:

1. Prior to fabrication, submit preliminary Samples panels showing corners, special shapes, or other conditions, all finished as specified.
2. Samples will serve as the control for limiting acceptable range of appearance.

C. Data:

1. Manufacturer Product Data sheet or equivalent printed literature indicating product information for panel anchorages, setting accessories and other related materials.
2. Data shall substantiate that the materials comply with the specified requirements.

D. Calculations: Calculations, stamped and certified by a California-registered professional engineer, to demonstrate structural adequacy of panels and anchorage system, and compliance with criteria specified. Coordinate calculations submitted with shop drawing submittals.

E. Manufacturer instructions: Manufacturer instructions for care, repair and replacement procedures, and Samples showing repaired panels.

1.4 QUALITY ASSURANCE

A. Fabricator/installer qualifications:

1. Single firm with a minimum of 5 years successful experience in the fabrication and erection of panel systems of similar sizes, shapes and finishes required for this Project, and which has ample production facilities to produce, furnish and supply the panels as required for installation without delay to the Work.
2. Firm must be regularly engaged in the engineering, fabrication, finishing and installation, of similar work.

1.5 HANDLING

A. Delivery:

1. After fabrication, protect panels with strippable plastic film.
2. Deliver panels to ensure that there will be no damage or staining.
3. Deliver other materials, except bulk materials, in manufacturer's unopened containers with name, brand, type, grade and color fully indicated thereon. Store bulk materials as required to avoid any deleterious effects of weather, soiling or contamination.
4. Delivered items shall be properly boxed or crated. Mark containers with installation location, fabrication/piece numbers, shop drawings reference, etc., as applicable.

B. Storage:

1. Store above grade on suitable surfaces using polyethylene film to separate panels from supporting or protecting members.
2. Protect from weather, soiling and damage of every kind.
3. Crate panels to prevent accumulation of moisture between panels.

1.6 SPECIAL WARRANTIES

A. Warrant that wall panels and their support system elements will meet the specified performance criteria specified and will be free from defects in materials and workmanship for 2 years after Substantial Completion, except where longer warranties are specified below.

1. Certify in writing that installed work is in accordance with the Contract Documents and authorized alterations and/or additions thereto and that, should defect develop during the warranty period due to improper workmanship or materials installed as a part of this Section, such defects will upon written request, be repaired or replaced at no additional cost to the Owner.
2. If exploratory work is required to determine the cause of the defects, the cost of such work shall be borne by the Contractor when his work is found to be at fault.

B. Further warrant the Owner in writing that wall panels will not evidence delamination of any type for 10 years after Substantial Completion.

C. Warrant finish against fading, chalking, peeling, cracking, checking, chipping, or erosion to base metal of the exterior panel finish for 10 years after Substantial completion.

D. Defective materials and workmanship are hereby defined to include evidence of abnormal deterioration or aging or weathering or work, structural failure of components resulting from exposure to normal load and forces, sealant failures, deterioration or discoloration of finishes in excess of normal weathering and aging, delamination, and failure to fulfill other specified performance requirements.

E. The warranty, the enforcement or lack of enforcement thereof, shall not deprive the Owner of other actions, rights or remedies available to him. Warranty shall be in form approved by Owner.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design requirements, general:

1. Drawings and specifications:

a. The Drawings and Specifications establish visual and performance requirements for the design, fabrication and installation of the metal panels.

1) The Contractor is responsible for the engineering and design of all components and materials as well as the fabrication, installation and performance of the panel system.
2) Contractor shall obtain necessary approvals and permits and pay costs therefore from public authorities having jurisdiction.

b. Drawings are diagrammatic:

1) The details shown are intended to establish basic profiles and dimensions, and interfacing requirements of the metal panels to and with other work.
2) Contractor is responsible for the design and engineering of the metal panels within these parameters.
3) The details indicated are incomplete. The Contractor shall develop conditions not detailed during the engineering and shop drawing process to reflect the level of aesthetics of the Project, and to comply with performance criteria specified.

B. Panel design: Design panels to meet or exceed the following structural and weather resistance requirements, as demonstrated by engineering calculations. Loads used in design shall be those prescribed by Code.

1. Structural requirements:

a. Perpendicular to the plane of the wall, net deflection of framing members shall not exceed L/175 times span, or 3/4-inch, whichever is less. Span is defined as the distance between anchor centerline. For cantilevers, span is defined as twice the distance between anchor centerline and end of cantilever.
b. Perpendicular to the plane of a soffit, net deflection of framing members shall not exceed L/600 times span under dead load support of panels. Span is defined as the distance between anchor centerlines.
c. In the plane of the wall, deflection of horizontal framing members shall not exceed L/360 or 1/8-inch, whichever is less. This includes horizontal rail sag due to dead load.
d. At connection points of framing members to anchors, combined movement of anchor relative to building structure, and framing member relative to anchor, shall not exceed 1/16-inch in any direction.
e. Stresses shall not exceed the allowable values established by the specifications listed in reference standards. In no case shall allowable values exceed the yield stress. Where permitted by Code, a 1/3 increase in allowable stress for wind or seismic load is generally acceptable, but not in combination with any reduction applied to combined loads.
f. Limit deflection of metal panels to L/120 of the span or 1/4 inch, whichever is less when tested in accordance with ASTM E 330 at specified design pressure. Measure deflection relative to the horizontal and vertical support members with the allowable deflection being determined by the lesser dimension.
g. At 150 percent of the design pressure loads for metal members supporting panels the net permanent deflection of framing members shall not exceed 1/1000 times span. There shall be no failure or gross permanent distortion of framing members,

anchors or connections. At connection points of framing members to anchors, combined movement of anchor relative to building structure, and framing member relative to anchor, shall not exceed 1/16 inch set after load is removed.

h. Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening or fracturing of attachments or components of system are not permitted in the installed work.

i. Design system so individual panel can be removed without removing or disrupting adjacent panels or materials.

2. Weather requirements:

a. Design wind loads shall be as indicated acting normal to the plane of the wall.

b. Wall panels shall be designed for a maximum deflection of L/180 under load.

c. Air infiltration of the wall panel system shall be limited to 0.06 CFM/ft^2 at a positive pressure differential of 1.57 psf when tested in accordance with ASTM E 283.

d. There shall be no uncontrolled water penetration to the building interior when the wall panel system is tested per ASTM E 331 at a positive pressure differential of 6.24 psf or 20 percent of the design wind pressure whichever is greater. The test pressure need not exceed 12 psf.

e. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1) Temperature Change (Range): 120 deg F ambient; 180 deg F, material surfaces.

2.2 MANUFACTURER

A. Basis of Design:

1. Morin Matrix Series Perforated Metal Wall Panels by Morin; a Kingspan Group Company. (MT-8).

B. Or equal.

2.3 MATERIALS

A. Aluminum Panels:

1. Coil Stock meeting ASTM B209; Alloy and temper as required for forming operations.
2. Thickness: 0.050 inch.
3. Panel Width: 12 inches.
4. Profile: MX 1.0.
5. Panel thickness: 1-1/2 inch thick.
6. Panel joint: Tongue and groove interlock joint.
7. Texture

a. MT-8: Perforated: Perforation Pattern; 3/16 inch holes: 33 percent open area - 5/16 inch hole spacing.

B. Flashing and trim: Fabricated in the same material, gage, finish, and color as the panels.

C. Subgirts: Fabricated from minimum 16-gage zinc coated steel conforming to ASTM A 653 SQ Grade 37, G90 coating.

2.4 ACCESSORIES

A. Fasteners: #14 minimum diameter, self-tapping, with hex head.

1. Exposed fasteners shall be 300 series stainless steel with 5/8" bonded neoprene and stainless-steel washers coated to match the exterior panel color.

B. Closure Strips:

1. Metal Profile Closure Strips: Shall be fabricated from same gauge, material and finish as metal panel.

C. Metal Framing: See Section 05 12 00 Structural Steel Framing.
D. Sealants:

1. Concealed sealant at side laps, end laps, and flashing details shall be gun grade non-curing butyl or polymeric non-skinning butyl tape to ensure weather tightness.
2. Exposed sealant shall be as specified in Section 07 92 00.

2.5 FABRICATION

A. Panel system components shall be fabricated in the factory for field-assembly to the greatest extent possible, under controlled environment in fabricator's plant in conformance with accepted shop drawings and calculations so tolerances, as stated herein, are not exceeded. Field fabrication of panels is not permitted.
B. Fabrication tolerances:

1. Panel bow: Maximum 0.2 percent of width or length, whichever is greater.
2. Width or length: Plus 0.064 to 48-inch; Plus 0.032 to 144 inch.
3. Thickness: Plus 0.008-inch
4. Squareness: 0.1875-inch difference between diagonals.
5. Camber: 0.062 inch maximum.
6. Radius of exterior bent corners: 1/16-inch maximum.

2.6 FINISHING

A. Exterior Finish: Fluropon PVDF, full 70% Kynar® 500/Hylar 5000®
B. Interior Finish: Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; finish coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
C. Color:

1. MT-8: **Chromium Gray,** See Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structure that will support the metal panel support system. Verify elevation, tolerances, offset lines, and other conditions that would affect the satisfactory installation and performance of the panels.
B. Correct unsuitable conditions before proceeding with erection.

3.2 PREPARATION

A. Examine surfaces and supports to receive panels. Make they are secure and properly aligned.
B. Do not begin installation of panels until Architect has accepted secondary air/water barrier.

3.3 INSTALLATION

A. Install panels and panel support members in compliance with the approved shop drawings, calculations, and fabricator's published instructions.
B. Install panels so that in their final location and position joints are uniform, perfectly aligned, with flush joints, and panels are not twisted out of plane.
C. Adjust work to conform to the following tolerances (maximum variations):

1. Face width of joints: Plus 1/32 inch.
2. Joint taper: 1/100-inch/foot length, with a maximum length of tapering in one direction of 6 feet.
3. Jog in alignment of edge: Plus 1/16 inch.
4. Rough opening dimension: Plus 1/16-inch at head, Plus 1/16 inch at sill, and Plus 1/16 inch at jamb.
5. Deviation from plumb, 1/16 inch maximum per one story height and a maximum of 1/8 inch in a 45 feet run.
6. Deviation from horizontal: 1/8 inch maximum in a 30 feet run.

3.4 SEALANTS

A. Comply with the requirements of Section 07 92 00 for sealants, backer rods, and their installation.

3.5 CLEANING AND PROTECTING

A. Leave protective film on panels in place as long as possible where doing so will not produce discoloration or other undesirable visual defects.
B. Remove protective film when, and in the manner, recommended by panel manufacturer’s instructions.
C. Clean panels in accordance with their manufacturers' published recommendations.
D. Protect panels from damage. Repair or replace damaged panels to Architect's satisfaction.

3.6 ACCEPTANCE

A. Each panel will be subject to the Architect's approval or rejection.
B. Panel or panels may be rejected after installation.
C. Carefully remove rejected panels and replace with new panels without delay and without cost to the Owner.
D. Remove panel or panels damaged in the removal of defective or rejected panels, and replace with new panels.

END OF SECTION

SECTION 07 42 19 - COMPOSITE METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes panel system and the following components:

1. Aluminum-faced composite panels rain screen system (ACM) with mounting system at trellis and cornice elements.
2. Panel mounting system including anchors, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete watertight-installation.

B. Related requirements: Division 07 for other sheet metalwork.

1.2 DEFINITIONS

A. Panel:

1. Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials.
2. The core material shall be free of voids and shall not contain foamed insulation material.
3. Products laminated sheet by sheet in a batch process using glues or adhesives between materials are not acceptable.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference:

1. Meet with Owner, Architect, ACM panel fabricator/Installer/manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects ACM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to ACM panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect ACM panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for ACM panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

B. Coordination: Coordinate ACM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation. This Section is responsible for incidental moisture intusion via venting and weeping.

1.4 SUBMITTALS

A. Shop Drawings: Dimensioned Shop Drawings showing materials, gages, methods of fabrication and assembly, joints, finishes and all other pertinent data.

1. Show panel layout, details edge conditions, joints, corners, panel profiles, supports, anchorages, trim, flashings, closures, and special details.
2. Distinguish between factory and field assembled work.

B. Samples: 12-inch long by actual panel width Samples in profile, style, color, and texture indicated. Include panel accessories.

C. Data: Manufacturer including product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.

D. Code Compliance: Documents showing product compliance with the national and local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

1.5 QUALITY ASSURANCE

A. Installer qualifications: Firm with a minimum of 5 years' experience in installation of exterior metal panels of scope and complexity similar to those of the Project.

B. Composite Panel Manufacturer shall have a minimum of 20 years' experience in the manufacturing of this product.

C. Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of the finish.

D. Fabricator/installer shall be acceptable to the composite panel manufacturer.

E. Field measurements should be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

F. Shop drawings shall show the preferred joint details providing a structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by ASTM E 331. Systems not utilizing a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated System) shall provide a means of concealed drainage with baffles and weeps for water which may accumulate in members of the system.

G. Maximum deviation from vertical and horizontal alignment of erected panels: 1/4-inch in 20-feet non-accumulative.

H. Panel fabricator/installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

I. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for ACM fabrication and installation.

1. Build mockup of typical MCM panel assembly in situ as directed by the Architect including corner, supports, attachments, and accessories.
2. Once reviewed by the Architect, acceptable mockup can form a permanent part of the Work, and will form the basis for acceptance for the remainder of the Project.
3. Remove and replace materials found not acceptable at no cost to the College.

1.6 HANDLING

A. Protection: Cardboard covers, strippable film or other form of protection standard with the fabricator.

B. Delivery:

1. Deliver panels and other components so they will not be damaged or deformed.
2. Exercise care in unloading, storing, and erecting panels to prevent bending, warping, twisting, and surface damage.

C. Storage:

1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering.
2. Store metal wall and roof panels so that they will not accumulate water.
3. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 WARRANTY

A. Furnish panel manufacturer's written warranty covering failure of the factory-applied exterior finish on metal panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Warranty period for factory-applied finish is 20 years after Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design wind pressure: Wind loads prescribed by Code or ANSI A50.1, whichever is more restrictive, but in no case less than 20 psf.
B. Thermal movements:

1. Provide assemblies, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
2. Temperature change (range): 120-degree F. ambient, 180-degree F. material surfaces.

C. Performance requirements:

1. Engineering responsibility: Engineer, fabricate and install the assemblies to limit air and water infiltration, as specified below, and to safely support, without failure and a maximum deflection of L/240, the wind load specified above, both positive and negative with support spacing not less than the maximum spacing for the Project.

a. Fasteners and connections are shown schematically. Final types and sizes shall be determined by a California-licensed civil or structural engineer employed by the Contractor.
b. In no case shall the fasteners or connections conflict with or require revision of the finish profiles of the panels or the supporting work.
c. Connections to the structural frame shall not impose any eccentric loading, or induce twisting or warping.
d. Connections of panels to supports shall be able to accommodate misalignment of the structure within limits allowed by the AISI, and AISC tolerances.

e. The panels shall have enough rigidity to keep oil-canning to a minimum within a temperature range of 150-degree F. With shop drawings submit anticipated distortion measured in a diagonal line drawn from each corner.

2. System performance requirements: Provide certified test results by a recognized testing laboratory or agency in compliance with specified test methods for each system.

a. Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Architect and/or the local building code.
b. Panels shall be designed to withstand the design wind load, but in no case less than 20 psf and 30 psf on parapet and corner panels. Wind load testing shall be conducted in accordance with ASTM E 330 with the following results:

1) Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4-inch, whichever is less.
2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.
3) Maximum anchor deflection shall not exceed 1/16-inch.
4) At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16-inch.

c. Air infiltration: When tested in accordance with ASTM E 283, air infiltration at 1.57 psf must not exceed 0.06 cfm/ft² of wall area.
d. Water infiltration - Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated Systems) shall be designed to drain water leakage occurring at the joints. No water infiltration shall occur in system under a differential static pressure of 6.24 psf after 15 minutes of exposure in accordance with ASTM E 331.
e. Pressure equalized rain screen systems: Comply with AAMA 508 “Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems.”
f. Provide assemblies that operates quietly at all times and without:

1) Vibration harmonics.
2) Wind whistles.
3) Noises caused by thermal movement (including “popping” and “ticking”).
4) Thermal movement transmitted to other building elements
5) Loosening, weakening or fracturing of attachments or components or system.

2.2 PANEL PERFORMANCE

A. Panel bond-integrity: When tested for bond integrity, in accordance with ASTM D1781 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values:
B. Peel strength: 22.5-inch lb/in as manufactured; 22.5-inch lb/in after 21 days soaking in water at 70-degree F

C. Fire performance:

1. ASTM E 84: Flame Spread Index must be less than 25, Smoke Developed Index must be less than 450.
2. ASTM D 1929: A self ignition temperature of 650-degree F or greater.
3. ASTM D 635: Requires a CC1 classification.

D. Adhesion:

1. Test Method: ASTM D 3359.

E. Coating shall not pick off when subjected to an 11-inch x 11-inch x 1/16-inch grid and taped with #600 Scotch Tape.

F. Humidity resistance

a. Test method: ASTM D 2247.
b. No formation of blisters when subject to condensing water fog at 100 percent relative humidity and 100°F for 4000 hours.

G. Salt spray resistance:

1. Test Method: ASTM B-117; Expose coating system to 4000 hours, using 5 percent NaCl solution.
2. Corrosion creepage from scribe line: 1/16-inch max.
3. Minimum blister rating of 8 within the test specimen field.

H. Weather exposure outdoor:

1. Ten-year exposure at 45-dehree angle facing south Florida exposure.
2. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.
3. Maximum chalk rating of 8-inch accordance with ASTM D-4214.
4. No checking, crazing, adhesion loss.

I. Chemical resistance:

1. ASTM D 1308 utilizing 10 percent Muriatic Acid for an exposure time of 15 minutes. No loss of film adhesion or visual change when viewed by the unaided eye.
2. ASTM D 1308 utilizing 20 percent Sulfuric Acid for an exposure time of 18 hours. No loss of film adhesion or visual change when viewed by the unaided eye.
3. AAMA 2605 utilizing 70 percent reagent grade Nitric Acid vapor for an exposure time of 30 minutes. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D 2244.

2.3 MATERIALS

A. General: Provide materials selected for their surface flatness, smoothness and freedom from surface blemishes where exposed in the finished Work.

B. Metal panels:

a. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND®; 3A Composites USA Inc.; ALUCOBOND® PLUS or comparable product by one of the following:
b. Alcan Composites USA, Inc.

c. Mitsubishi Chemical America, Inc.
d. Or equal.

C. Aluminum face sheets: Thickness: 0.0157-inch (nominal), AA3000 Series alloy.
D. Extrusions, formed members, sheet, and plate: ASTM B 209 as recommended of the manufacturer.
E. Panel stiffeners, if required: Structurally fastened or restrained at the ends and secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.
F. Flashing materials: 0.030-inch minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

G. Sealant and backup: As specified in Section 07 92 00.

2.4 FABRICATION

A. Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.
B. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact to minimize noise from movements within panel system.
C. Back-cut panels and form corners to the smallest radius possible (1/16-inch maximum) without causing grain separation or otherwise damaging the work.
D. Design panels to be job-assembled without exposed fasteners.
E. Form panels with tolerances to accommodate expansion and contractions between panels and support.
F. Tolerances of completed assemblies shall not exceed the following:

1. Panel bow: 0.2 percent of panel dimensions in width and length but 0.1875-inch maximum.
2. Width or length: 0.064-inch.
3. Thickness: 0.008-inch.
4. Squareness: Less than 0.1875-inch difference between diagonal measurements.
5. Camber: Less than 0.032-inch.

2.5 FINISHING PANELS

A. Finish paint system: Coil coated Kynar® 500 or Hylar® 5000 based Polyvinylidene Fluoride (PVDF) – 2, gloss level 20, in conformance with the following general requirements of AAMA 2605.

1. Color: See Drawings for color.
2. Coating thickness: 1.0 mil (±0.2 mil).

B. Exposed surfaces:

1. Preparation: Remove oxidization, fabrication burrs, oil, grease and other deleterious materials before priming.
2. Prime coat: Spray primer over the prepared metal surfaces in compliance with the paint manufacturer's instructions to provide a uniform dry film not less than 4 mils thick.
3. Finish coat: Apply finish coat smooth and even, free of runs, sags, orange peel, holidays or other imperfections, as approved by the Architect.

C. Concealed steel surfaces, including reinforcement and attachments (concealed aluminum surfaces may be primed only):

1. Preparation: Prepare the metal for painting in compliance with SSPC SP-l, Solvent Cleaning.
2. Shop primer: Spray zinc-rich primer over the prepared surfaces in compliance with the paint manufacturer's printed instructions to produce a uniform dry film not less than 1-1/2 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM wall panel manufacturer.

1. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

C. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Clean debris, dust and other foreign materials behind the work, as it is erected.
B. Provide temporary closures if necessary to prevent the accumulation of such materials behind this work.

3.3 INSTALLATION

A. Install metal panels in accordance with the approved shop drawings and their manufacturer’s instructions.
B. Keep cutting, drilling and fitting required for installation of the panels at the job site to a minimum.

C. Set panels accurately in their proper location, alignment and elevation, plumb, level, true and free of rack as measured from established lines and levels, within the following tolerances:

1. Limit panel to panel offset to a maximum of 1/32-inch.
2. Limit tolerance, as measured with a 10-foot straightedge to 1/16-inch in any direction.
3. Tolerances are non-cumulative.

D. Assemble metal panels with flush, hairline joints and concealed fasteners. Comply with manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates.

E. Provide for thermal and building movement without over-stressing the material, breaking connections or producing wrinkles and distortion in finished surfaces.

F. Make installations weathertight at all locations.

G. Anchor panels and other components of the work securely in place with concealed clips, to permit movement without damage where subject to thermal expansion and contraction. Exposed fasteners are not permitted from surfaces normally visible by the public and the building occupants.

H. Joint sealers:

1. Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of assemblies.
2. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.
3. Refer to Section 07 92 00 for sealants and installation requirements.
4. Do not obstruct weep holes and drainage channels; clean free of dirt and sealants.

3.4 TOUCHUP

A. Remove protective covering as soon as no longer needed.

B. If touchup is required, use the same primer and paint as for shop finished materials. The touchup work must be invisible under normal lighting conditions from a distance of 2 feet.

C. Replace damaged panels which, in the Architect's opinion, cannot be successfully touched-up in the field, with undamaged materials.

END OF SECTION

SECTION 07 54 19 - PVC ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Adhered thermoplastic (PVC) roofing membrane.
2. Sheet metal flashings at the perimeter penetrations of the roof membrane.
3. Liquid applied membrane (LAM) flashings at equipment pads and penetrations where use of PVC flashing membrane is not practical or as noted on the design details
4. Flat and tapered insulation, crickets, and cover board.
5. Adhesive, fasteners and anchors to attach the roof membrane to concrete substrate and metal decks.

B. Related requirements: Division 07 for other sheet metal flashings and insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:

1. Sequence work to avoid traffic by equipment or personnel over completed roofing. Where such access is inevitable, provide necessary protection and/or barriers to segregate the work area and to prevent damage to adjacent areas.
2. Do not store materials on completed membrane surfaces. Where storage or traffic is unavoidable provide plywood, additional protection boards or similar protection to prevent damage to the membrane. Notify the membrane manufacturer that traffic or storage is anticipated.
3. All conduit, utilities boxes, inserts, penetrations and drains shall be in place, grouted where required and permanently fixed to the substrate before the insulation and membrane are installed.

B. Pre-installation meeting:

1. Prior to start of installation arrange a pre-installation meeting between the waterproofing manufacturer authorized representative, the Contractor, the Architect, and the installer of to review Project conditions, the Drawings, Specifications and the waterproofing manufacturer data.
2. If more than one trade will be responsible for the successful performance of the work of this Section, these trades shall attend the meeting.
3. Identify areas of concern and remedial measures.
4. Record meeting minutes and distribute PDF copy to all concerned, including the Architect, within 48 hours after the meeting.

1.3 SUBMITTALS

A. Product data:

1. Roofing system: Describe each material, and include installation instructions.
2. Insulation: Written approval by the insulation manufacturer for use and performance of the product in the proposed system.

B. Shop drawings:

1. Show outline of roof and its respective size.

2. Show roof topography, identify slopes and gradients.
3. Provide large scale details of roof drains, each flashing component, penetrations and terminations, and locations of stone ballast and walking pads.

C. Samples: Samples of each material to be used in the roof system including each component manufacturer's literature.

1. Make roof membrane Samples a minimum of 24 inches square with one welded joint.
2. Make flashing Samples a minimum of 6 inches long.

D. Warranty:

1. Roofing membrane manufacturer warranty form.
2. Roofer warranty form.

1.4 QUALITY ASSURANCE

A. Acceptance:

1. Technical acceptance from roofing membrane manufacturer of the roofing system.
2. Certifications by producers of roofing and insulating materials that materials supplied comply with requirements of the identified ASTM and industry standards.
3. Certification that system specifications meet all identified code and insurance requirements.

B. Roofer qualifications:

1. Roofing system shall be applied only by a firm authorized in writing, by the roofing membrane manufacturer, to apply roof membrane specified.
2. Upon completion of installation, and delivery to roofing membrane manufacturer by the Contractor of a certification that work was done in accordance with Specifications and roofing membrane manufacturer requirements, an inspection shall be made by a technical representative of roofing membrane manufacturer to observe the roof system.
3. Work pertaining to the installation of roofing membrane and flashings shall only be completed by applicator personnel trained and authorized by roofing membrane manufacturer in those procedures.

C. Code requirements: Submit evidence that the proposed roof system will meet Code requirements and has been tested and approved or listed by the following testing organizations.

1. FM (Factory Mutual Research Corp.) FM I-90 wind uplift resistance.
2. UL (Underwriters Laboratories, Inc.) Class A membrane.

1.5 HANDLING

A. Delivery: In original unopened containers or wrappings.
B. Storage:

1. Handle materials to prevent damage. Place materials on pallets and fully protected from moisture.
2. Store membrane rolls lying down on pallets, and fully protected from moisture with clean canvas tarpaulins. Unvented polyethylene tarpaulins are unacceptable.
3. Store adhesives above 40-degree F.
4. Store flammable materials in a cool, dry area away from sparks and open flames.
5. Remove damaged materials from the job site and replace at no cost to the Owner.

1.6 JOB CONDITIONS

A. Install materials when environmental conditions are within range acceptable to the roofing membrane manufacturer.
B. Install only materials as much of new roofing as can be made weathertight each day, including all flashing and detail work.
C. Surfaces to receive insulation, membrane, and flashings shall be dry. Should surface moisture occur, provide the necessary equipment to dry surface prior to application.
D. Install uninterrupted waterstops at the end of each day's work, and completely remove them before proceeding with the next day's work.
E. Prior to and during application of insulation and roofing membrane, remove dirt, debris and dust from surfaces either by vacuuming, sweeping or blowing with compressed air and/or similar methods.
F. Conduct fastener pullout tests in accordance with industry standards to help verify condition of deck/substrate and to confirm expected pullout values.

1.7 SPECIAL WARRANTIES

A. Special warranties: The manufacturer and the roofer, as noted below, shall repair defects within the warranty period at no cost to the Owner. If work related to roofing, flashing, or metal is found to be within the roofer and/or manufacturer warranty term, defective or otherwise not in accordance with the Contract Documents, the roofer and/or manufacturer, as specified below, shall repair defect(s) at no cost to the Owner.

1. Defects are defined as follows:

a. Failure of the roof and flashings to remain weathertight during the warranty period.
b. Discoloration of the roof membrane other than caused by normal aging; uneven discoloration will be deemed a defect.
c. Lack of adhesion to substrate, such as evidenced by bubbles (trapped air) under the roof membrane.

2. Manufacturer warranty: Manufacturer shall warrant roofing and flashings against defective materials for all supplied components, and roofer's workmanship, for 20 years after Substantial Completion. Warranty shall not be prorated, shall not include dollar limit, and shall not exclude, without time restriction, ponding water.
3. Fluid-Applied Membrane System, 20 Year Warranty.
4. Roofer's warranty: Roofer shall supply the Owner with a separate 5-year workmanship warranty. The installer's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide roofing membrane that prevents the passage of water in the building.

2.2 MEMBRANE SYSTEM

A. Basis of design: Sika Sarnafil 80 mils thick G410 fiberglass reinforced membrane with a lacquer coating. Membrane shall conform to ASTM D 4434, "Standard for Polyvinyl Chloride Sheet Roofing" Classification: Type II, Grade I.
B. Other acceptable manufacturers:

1. Elvaloy alloyed PVC membranes: Seaman Corp. "Fibertite.

2. PVC membrane: Durolast.

2.3 FLASHING MATERIALS

A. As supplied by roofing membrane manufacturer.
B. Flashing materials shall be same material as roofing membrane, except that the metal portion of the flashing shall be Type 316 stainless steel.

2.4 LIQUID-APPLIED FLASHINGS

A. Fluid-Applied Membrane System Sikalastic RoofPro 20 with Sika Reemat Premium, basis of design or equal:

1. Primer: Sikalastic EP Primer
2. Base Layer: Sikalastic 641 Lo-VOC, 50 mils wet film thickness, 32 sf/gal coverage rate approx.
3. Reinforcing Layer: Reemat Premium.
4. Top Layer: Sikalastic 641 Lo-VOC, 30 mils wet film thickness; 53 sf/gal coverage rate approx.
5. Sealant for fillet bead applications and membrane penetrations shall be Sikaflex® 11FC by Sika Corp.
6. Supplemental reinforcement shall be Sika Flexitape Heavy by Sika Corp.

2.5 ADHESIVES

A. Water-based adhesive for membrane attachment to cover board substrate.
B. Low rise foam adhesive for insulation and cover board attachments.
C. Adhesives must be acceptable to the roof membrane manufacturer for the conditions of use.

1. PVC surfaces: Sarnacol 2121 VOC-compliant adhesive for vertical concrete and steel deck surfaces.
2. Insulation Board Adhesive: Sarnacol 2163, Sarnacol AD or Sarnacol OM Adhesive: One step low-rise polyurethane foam used to attach insulation to approved compatible substrates. Adhesive is applied with a gravity fed applicator or by hand with a dual component caulk gun in beads. Additional adhesive may be required for rougher surfaces.
3. Stabond Adhesive.: Low VOC reactivating-type adhesive used to attach membrane to vertical flashing substrate.

2.6 INSULATION AND FASTENERS

A. Insulation: Flat and tapered polyisocyanurate insulation with inorganic coated fiberglass facers compatible with the specified roofing membrane, acceptable to the roof membrane manufacturer, and to obtain a thermal resistance (R value) indicated.
B. Fastener: Self-tapping, #12 corrosion-resistant fastener acceptable to the roofing membrane manufacturer.

1. Perform pullout tests by the fastener manufacturer.
2. Results of these tests plus and an assessment by the fastener manufacturer regarding the suitability of the fastener for the Project is required.

2.7 ACCESSORIES

A. Sarnaclad: PVC-coated, heat-weldable 25-gage, Type 316 stainless steel sheet with a 20-mil unsupported Sarnafil membrane laminated to one side.
B. Sarnastack Universal: Vent pipe flashing fabricated from 0.0604-inch-thick PVC membrane.

C. Sarnacircles “G”: Circular 0.048-inch thick G410 membrane patches welded of T-joints formed by overlapping thick membranes.
D. Sika 11FC: 2-component urethane sealant used for pitch pocket topping.
E. Sarnacorner: Prefabricated inside and outside corners made of 0.060-inch thick PVC membrane heat-welded to membrane or flashing.
F. Sarnaplate: 26 gage, 3-inch plate used with fasteners to clamp insulation boards in place.
G. Sarnafasteners:

1. XPS, #15 heavy-duty, corrosion resistant fastener, shank diameter of 0.21-inch and thread diameter of 0.26-inch, with a driving head of 0.435-inch and #3 Phillips design.
2. Sarnadisc XPS, 18 gage, 2-inch by 3-3/4-inch linear steel plate.

H. Sarnastop: Extruded aluminum, low profile bar installed over the membrane and made watertight with a welded cover-strip, used at all angle changes.
I. Sealants: Sarnafil multi-purpose sealant for termination details.
J. Aluminum tape: 2-inch wide pressure-sensitive tape acceptable or provided by Sarnafil.
K. Sarnasolv: Solvent cleaner for the specified membrane surface.
L. Walkway pads: Sarnatred (welded), or equal.
M. All other accessories: As recommended by the roofing membrane manufacturer.
N. Peelstop: Extruded aluminum, low profile bar used with certain fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate.

2.8 MISCELLANEOUS MATERIALS

A. Wood nailers: Refer to Section 06 10 50.

1. Do not use creosote or asphaltic-treated lumber.
2. Wood nailers shall conform to FM Loss Prevention Data 1-49.

B. Cover board: “Dens-Dek Prime” or “DensDeck DuraGuard Roof Board” by Georgia Pacific – no substitution. Use 1/2-inch-thick board.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Manufacturer’s inspections:

1. Request the manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.
2. Unsatisfactory conditions disclosed by the manufacturer visits to the site shall be documented, and promptly and satisfactorily repaired and the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

B. Examine substrates, conditions and surfaces to/under which materials will be applied/installed to receive materials.
C. Inspect deck for defects that will adversely affect the quality of work.
D. Conduct fastener or adhesion pullout tests in accordance with industry standards to help verify condition of deck/substrate and to confirm expected pullout or adhesion values.
E. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's instructions. Remove sharp projections.
B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Ensure that drains are functioning normally prior to starting this work. Remove roof-drain plugs when no work is taking place or when rain is forecast.
C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
D. Coordinate the installation so that each roofed area is made watertight at the end of each day.

3.3 SUBSTRATE PREPARATION

A. Inspect deck for defects that will adversely affect the quality of this work.
B. Substrates shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Do not start roofing until defects are corrected, and work of penetrating and adjacent installations is completed.
C. Roof surfaces shall be free of water and other deleterious substances.
D. Apply roofing systems over compatible and acceptable substrates only.

3.4 WOOD NAILERS

A. Install continuous treated wood nailers, of same thickness as insulation height, at the perimeter of the entire roof and around roof projections and penetrations.
B. Anchor nailers to resist a minimum force of 300 lb./linear foot in any direction.
C. Provide a 1/2-inch space between nailer lengths.
D. Individual nailer lengths shall not be less than 3-foot long.
E. Space fasteners at 12-inch o.c. Stagger fasteners 1/3 the nailer width and install within 6-inch of each end.
F. Nailer attachment shall meet this requirement and current FM Loss Prevention Data Sheet 1-49.

3.5 INSULATION & COVER BOARD

A. Mechanically-attach insulation with approved fasteners to the decks as recommended by roofing membrane manufacturer and in compliance with FM for fastening rates and patterns.
B. Do not install more insulation board than can be covered with membrane by the end of the day or the onset of inclement weather.
C. Use at least 2 layers of insulation when the total thickness exceeds 2.5-inch. Stagger joints at least 12-inch between layers.
D. Attach insulation as recommended by the insulation manufacturer, FM and roofing membrane manufacturer instructions, and so that insulation boards rest evenly on the substrate. Install each insulation board tightly against the adjacent boards on all sides.
E. Adhesively adhere cover board over the insulation with tight, flush joints, in accordance with the roof membrane manufacturer’s instructions. Break joints between the insulation and the cover board.

3.6 ROOFING MEMBRANE & WALKWAY PADS

A. Install roof membrane over clean, dry substrate in accordance with its manufacturer’s instructions.
B. Hot air-weld seams continuously.

C. Install walkway pads in the pattern indicated over the completed roof membrane. Adhere fully to roof membrane as recommended by the membrane manufacturer or lay loose when acceptable for the product selected.

3.7 METAL FLASHINGS

A. Install concurrently with roof membrane as the work progresses, in accordance with the roofing membrane manufacturer instructions, to seal all edges and penetrations.

3.8 LIQUID APPLIED MEMBRANE FLASHING SYSTEM (LAM)

A. Install liquid applied flashing membrane system at irregular and non-standard penetrations and substrates only.

1. Mix and apply the specified primer per the instructions on the technical data sheet.
2. Allow to cure and dry in accordance with manufacturer's technical data sheet.
3. For all horizontal-to-vertical transitions, provide a 3/4-inch x 3/4-inch Sikaflex polyurethane sealant cant.
4. Apply a minimum of a 3-inch-wide strip of Joint Tape SA or Sika Flexitape Heavy.
5. Install liquid applied flashing resin and reinforcement per manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Seams:

1. Check welded seams for continuity daily where directed by roofing membrane manufacturer's representative.
2. Take one-inch-wide cross-section Samples of welded seams at least 3 times a day.
3. Correct welds displaying failure from shearing of membrane prior to separation of weld. Patch each test cut.

B. Roofing membrane is subject to review by Architect and roofing membrane manufacturer.

1. Note defects and non-compliance with Specifications and itemize roofing membrane manufacturer's recommendations in a punch list.
2. These items must be corrected immediately to the satisfaction of the Architect and roofing membrane manufacturer prior to demobilization.

3.10 DEMONSTRATION

A. Provide maintenance documents and personal instruction to the Owner for the following:

1. Access restrictions and precautions.
2. Avoiding mechanical damage.
3. Potential contaminants and rectification.
4. Cleaning.
5. Emergency repairs.

END OF SECTION

SECTION 07 62 00 - FLASHINGS AND SHEET METALWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Overflow scuppers.
2. Gutters, conductor heads and downspouts.
3. Copings.
4. Prefabricated counterflashing assemblies.
5. Flashing collars for roof screen supports.
6. Air intake louver.
7. Storefronts and curtain wall sill pans and dams.
8. All other flashings and sheet metal items shown or required to make the building weathertight and not specified in other Sections.

B. Related requirements:

1. Division 08 for flashings in connection with window wall and skylights, and counterflashings at perimeter of skylights.
2. Division 09 for finish painting flashings and sheet metalwork.
3. Division 23 for mechanical sheet metal work, and flashings and collars for mechanical and electrical work, except as specified herein for roof drains.

C. Definitions:

1. In general, flashings visible by the public shall be prefinished aluminum.
2. All other flashings shall be stainless steel.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting:

1. Prior to starting installation, arrange a pre-installation meeting between trades responsible for flashings and trades whose systems interface with flashings.
2. Attendees shall also include, but are not necessarily limited to the following:
    a. Contractor.
    b. Architect.
    c. Project roofing and waterproofing consultant.
    d. Roofing material manufacturer’s technical representative.
    e. Representatives of waterproofing, fenestration, exterior building envelope, weatherproofing and exterior cladding systems.
3. Those present shall review the Drawings and Specifications, and typical flashing details.
4. Identify areas of concern and proposed remedial measures. Take photographs of the areas of concerns, before and after remedial measures are taken.
5. Record meeting minutes and distribute PDF copy to all concerned, including the Architect, within 48 hours of the meeting.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data, specifications, installation instructions and general recommendations for installation of prefabricated assemblies.

B.

C. Shop Drawings:

1. Show typical and atypical details, including, but not limited to sheet metal components as well as all transitional and interface flashings between the various roofing, waterproofing and exterior building envelope weatherproofing assemblies, such as wall cladding and fenestration. Include material weight, methods of joining and attachment, and relationship with adjacent materials and supports of all sheet metal assemblies.
2. Detail interface with adjacent materials. For interface between flashings with different profiles and conditions difficult to illustrate in 2-dimension, furnish isometric drawings. Key sheet metal components, transitional and interface flashings, and associated materials to the Drawings, and show typical locations and profiles.

D. Samples: Assembled Samples of the following at least 6 inches long, except as otherwise specified. Mount on plywood and include all components to be installed under this Section for each Sample.

1. Complete coping, including inside and outside corner condition, with legs at least 12 inches long; include typical moving and non-moving joints. Inside and outside corners must be fully soldered; sealant joints at those locations are unacceptable.
2. Scupper.
3. Gutter including holding strap.
4. Conductor head and downspout.
5. Counterflashing with receiver.
6. Rain bonnet.

1.4 QUALITY ASSURANCE

A. Design criteria and performance requirements: Fabricate and install the work of this Section to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, excessive oil-canning, and fastener disengagement.

1. Thermal movements:

a. Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
b. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.
c. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
d. Temperature change (range) of 120-degree F ambient; 180-degree F, material surfaces.

2. Water infiltration: Provide sheet metalwork and flashings that do not allow water infiltration to building interior, and to damage materials, such as insulation, in exterior walls.

1.5 HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the design pressures indicated on Structural Drawings.

2.2 MANUFACTURER

A. Manufacturer/type:

B. Performance Requirements:

2.3 MATERIALS

A. Sheet steel: Commercial quality carbon steel sheets complying with ASTM A 653, lock-forming grade, galvanized with a G90 zinc coating, 24-gage (0.025 inch) minimum unless otherwise indicated, known commercially as "Satincoat", or "Galvanneal." Steel sheet thicknesses specified are base metal thicknesses prior to galvanizing.

B. Increase gage of galvanized sheet steel for larger sheet applications, such as gutters, curbs, etc.

1. Sheet lead for roof drains: 4 lb./square-foot, ASTM B 29 desilverized pig lead.

C. Stainless steel: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1) Run grain of directional finishes with long dimension of each piece.

2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Copper-coated stainless steel: CopperPlus by Engineered Materials Solutions.

E. Zinc-alloy: ASTM B 69, not less than 95 percent zinc, 0.6percent Copper and 0.14 percent titanium; standard (soft) temper), cold-rolled, 0.032-inch thick.

F. Copper: ASTM B 370, cold-rolled, 16 oz./square-foot, CDA 2B finish.

G. Aluminum:

1. Sheet aluminum: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface. (0 .03 inch thick.)

2. Aluminum extrusions: ASTM B 229.

3. As-Milled Finish: Mill.
4. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
5. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
6. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Color: As indicated on Drawings.
8. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

H. Nails:
1. For attaching sheet steel to wood: Large flat head "stronghold" type roofing nails with barbed point, formed of hot-dip galvanized steel of sufficient length to penetrate a minimum of one-inch into the wood nailer.
2. For attaching sheet steel to concrete: 1-1/4-inch by 8d hot-dip galvanized hardened steel nails with lead washers.

I. Hot dip galvanized self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Fasteners for flashing and trim: Blind fasteners or self-drilling screws, gasketed with hex washer head.
2. Blind fasteners: High-strength aluminum or stainless-steel rivets.

J. Solder and flux:
1. Galvanized sheet metal: 50-50 lead/tin solder complying with ASTM B 32, used with a non-corrosive flux.
2. Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
4. Lead-coated copper: ASTM B 32, Grade Sn60, 60 percent tin and 40 percent lead.
5. Stainless steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

K. Sealing tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing.
1. Provide permanently elastic, nonsag, non-toxic, non-staining tape.
2. Tremco 440, Schnee-Morehead, Inc. SM5700, or equal.

L. Expansion-joint sealant: For hooked-type expansion joints, which must be free to move, provide non-setting, non-hardening, non-migrating, heavy-bodied polyisobutylene sealant.

M. Bituminous coating:
1. Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.
2. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

N. Insect screens: 14 by 18 mesh, 0.063-inch diameter aluminum wire crimped screen material.

O. Slip sheet: Red Rosin Building paper, minimum 12 lb./100 square feet by W.R. Meadows or equal.

1. Size: 36 inches by 150 feet.

P. Downspout filter: Flo-Gard for downspout sizes by Oldcastle infrastructure, a CRH Company(models per downspout diameter).

2.4 UNDERLAYMENT MATERIALS

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.

C. Source Limitations: Obtain underlayment from single source from single manufacturer.

D. Slip sheet: Red Rosin Building paper, minimum 12 lb./100 square feet by W.R. Meadows or equal.

1. Size: 36 inches by 150 feet.

2.5 FLEXIBLE FLASHING

A. Flexible flashing materials installed under, or interface with sheet metal. Protect flexible flashing materials from UV exposure; do not leave uncovered in excess of the material manufacturer's published exposure limits.

B. Self-adhering waterproofing membrane materials shall be either manufactured by the Air and Water Barrier material manufacturer as part of their system or approved for use as being compatible with the Air and Water Barrier system specified in Section 07 27 26.

1. General: For use in high temperature environments (temperatures in excess of 225 degrees F.), provide flashing rated by the flexible flashing manufacturer as "high temperature resistant" and suitable for its intended use and application.
2. For use on exterior walls, where neither metal flashing, air and water barrier, or high-temperature flashings occur:

    a. Perm-A-Barrier by GCP Applied Technologies.
    b. Window and Door Flashing by Carlisle Coatings & Waterproofing.
    c. Fast Flash by Protecto Wrap Co.
    d. Sealtight Air-Shield by WR Meadows, Inc.
    e. Seam Seal Tape by SafSeal Innovations.
    f. TW Moisture Wrap by Tamko Waterproofing.

3. For use under copings and other sheet metal assemblies: Self-adhering (peel and stick) flexible high-temperature resistant, self-adhering waterproofing flashings by one of the following, and shall include primers, sealants and mastics, liquid membrane and accessories required for complete systems.

    a. WIP 300HT-by Carlisle Coatings & Waterproofing.
    b. PW 100/40 HT by Protecto Wrap Co.
    c. Grace Ultra by GCP Applied Technologies.

2.6 PREFABRICATED ASSEMBLIES

A. Counterflashing assemblies: Formed of 24-gage galvanized sheet steel, of the profiles shown on the Drawings, complete with factory-formed internal and external corners, and end closures by one of the following.

1. Basis of design is for Fry Reglet Corp. Type ST (stucco), CO (concrete), SM (surface mounted).
2. Keystone Flashing Co.
3. CF Cheney Flashing Co.
4. MM Systems Corp.

B. Strainer units for conductor heads: Removable beehive design fabricated from 0.062-inch diameter galvanized steel wire or wire mesh with openings not more than 1/2-inch.

C. Prefabricated expansion gutter joints: “Expansion Joint” by Wilco, or “T-Pren Expansion Joint” by Matthew Hebden.

D. Sheet metal curbs:

1. Of the sizes and profiles indicated, by Thybar Corp., Pate Co. or Custom Curb, Inc., with an 18-gage galvanized steel shell and base plate fully welded, factory installed insulation, and continuous wood nailer.
2. Reinforce curb as required to safely support the equipment thereon.

E. Gravity roof vents (louvered penthouses):

1. Extruded and cold-formed aluminum assemblies by C/S, Bristol Fiberlite Industries or equal.
2. Provide with insect screen in removable aluminum steel frame.
3. Refer to Drawings for model number.]

2.7 FABRICATION

A. General:

1. Shop fabricate flashings and sheet metal work to comply with profiles and sizes indicated on the Drawings and standard Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) detail plates of the "Architectural Sheet Metal Manual" as follows, unless otherwise indicated.

   a. Gravel stops and roof edging: Figure 2-5C.
   b. Laps: J2.
   c. Copings: Figure 3-4A. Miter and solder inside and outside corners continuously to make watertight; the use of sealant for that purpose is unacceptable.
   d. Gutter: Style A. Butt expansion joint Figure 1-7.
   e. Downspout: Figure 1-32A round; Figure 1-32B rectangular.
   f. Downspout hanger: Figure 1-35 to match shape of gutters.
   g. Scupper and conductor head: Figure 1-27A.

2. Form sheet metal on bending brake with straight, sharp edges. Shape, trim, and hand seam sheet metal on bench; keep job site forming to a minimum.
3. Comply with metal producers' recommendations for tinning, soldering, and cleaning flux from metal.
4. Fabricate with joints and corners accurately machined, filed and fitted, and rigidly framed together and connected.

B. Galvanized Sheet Metal flashing finish: Paint per Section 09 90 00.

C. Fabricate in as long length as possible to minimize field joints.

D. Prefabricate intersections, including counterflashings, with mitered, riveted joints. Make corners and intersections with legs a minimum of 24-inch long extending in each direction.

E. Tinning and soldering:

1. Tin edges on both sides of sheet steel to be soldered.
2. Perform soldering slowly, thoroughly heating seams and completely sweating solder through full width of seams.

F. Exposed edges: Neatly double back sheet metal 1/2-inch to stiffen edges and to provide a finished appearance.
G. Provisions for attachment to structure: Furnish supports, hangers, bracing, anchors and other devices shown, specified or necessary for reinforcement and proper attachment of flashings and sheet metal to building.
H. Metal thicknesses: Per SMACNA Architectural Sheet Metal Manual except that copings must meet 2.1 C above.

2.8 FINISHES

A. Galvanized Sheet Metal flashing: See Section 09 90 00.
B. Exposed aluminum-fabricated copings and running flashing: Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Custom color and Gloss as selected by Architect. Finish to be non-reflective.

C. Concealed aluminum: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 GENERAL REQUIREMENTS

A. In addition to the assemblies listed above, provide required sheet metal flashings, counterflashings, transitional and interface flashings required to achieve a properly weatherproofed, flashed and counterflashed building envelope, including sheet metal flashings in the angles formed where exterior waterproofed decks abut walls, and as well at curbs, platforms, ventilators, pipes, roof hatches, and other vertical and horizontal surfaces, where indicated and necessary to make the Work weatherproof.
B. Comply with manufacturer’s installation instructions where applicable, and applicable SMACNA and NRCA details, except as indicated and specified.
C. Install counterflashing assemblies at a constant height above the roof.

1. Anchor counterflashing securely into reglet by friction, or provide lead wedges spaced 2-foot o.c. maximum.
2. Use manufacturer standard splice plates and preformed corners for a weathertight assembly.

D. Coordinate this work with other trades whose work penetrates, intersects and adjoins flashings and sheet metal work, to permit the correct sequencing and the watertightness of the assemblies.
E. Isolate copper from dissimilar metals and pressure-treated wood.
F. Isolate aluminum from cementitious materials and dissimilar metals.

3.3 INSTALLATION

A. General:

1. Install sheet metal work in accordance with the approved Shop Drawings.
2. Fasten coping on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Except as specified, lap and solder corners

and angles; lapping and sealant method is not an acceptable substitute for coping corners; provide for thermal movement no more than 10 feet from corner.

3. Slope copings and sills with a minimum slope of 10 percent to drain away form walls and building interior. Slope gutters 1/4-inch per foot to drain.
4. Solder joints of window flashings (pans) and saddles.
5. Attach work securely to supporting construction, plumb, level, with tight, flush joints allowing for thermal movements.
6. Install work with lines, arises, and angles sharp and true.
7. Fold exposed edges neatly to form a 1/2-inch hem on the concealed side; hem all exposed edges, unless otherwise indicated.
8. Assemble work so that face of metal in contact has hairline joints, except where required for expansion or fitting. Provide back-up plates at joints.
9. Conceal fastenings and reinforcement where they would be visible by the public and the building occupants.
10. Vulcanize joints of the roof expansion joint covers and lap the sheet metal portion, after sealing for water tightness.
11. Finish work shall be straight, smooth and continuous, without dimples, dents and other damage.

B. Soldering:

1. Protect underlying waterproof membrane (flexible flashing) when soldering sheet metal.
2. Except as specified, solder all joints not intended for expansion and contraction.
3. Clean material and tin prior to soldering.
4. Solder slowly. Heat the seams thoroughly, and completely fill with solder.
5. Make exposed soldering on finish surfaces neatly, full flowing and smooth.
6. Wash acid flux with a soda solution after soldering and remove soldering flux on exposed surfaces.

C. Nailing:

1. Confine nailing of sheet metal generally to sheet metal having a maximum width of 18-inches. Nailing of flashings shall be confined to one edge only.
2. Space nails evenly not over 12-inches o.c., and approximately 2-inches from the edge.
3. Face nailing is not permitted. Do not nail sheet metal assemblies on horizontal surfaces.
4. Where sheet metal is applied to surfaces other than wood, furnish detailed Shop Drawings showing locations of required sleepers and nailing strips specified in Section 06 10 53 (06 10 00).

D. Cleats:

1. Provide cleats for sheet metal 18-inch and over in width. Space cleats evenly not over 12-inches o.c.
2. Make cleats not less than 2-inch wide by 3-inch long, and of the same material and thickness as the sheet metal being installed.
3. Secure one end of the cleat with 2 nails and the cleat folded back over the nail heads. Lock the other end into the seam. Pre-tin cleats for soldered seams.

E. Bolts, rivets, and screws:

1. Install bolts, rivets, and screws where required. Space equally and symmetrically.
2. Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
3. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
4. Provide compatible washers to protect surface of sheet metal and to provide a watertight connection.

F. Dissimilar material protection:

1. Protect sheet metal in contact with dissimilar metals, concrete, masonry and plaster with a heavy coating of bituminous paint, approved separation tape, or building felt or paper.
2. Set sheet metal assemblies supported by pressure-treated wood on building paper or felt attached to the wood nailer, except set copings on flexible flashing specified. Lap on vertical surfaces at least 2 inches.

G. Seams - general: Make seams straight, uniform in width and height, with no solder showing on the face.

1. Flat-lock seams: Finish not less than 3/4-inch wide made in the direction of water flow.
2. Lap seams: Finish soldered seams not less than one-inch wide. Overlap seams not soldered at least 3-inches.
3. Loose-lock expansion seams: No less than 3 inches wide, designed to provide minimum one-inch movement within the joint. Fill joint completely with sealant applied at not less than 1/8-inch thick bed.
4. Standing seams: Not less than one-inch high, double locked without solder.

H. Expansion and contraction:

1. Provide for thermal and building movement without over-stressing the material, breaking connections or producing wrinkles and distortion in finished surfaces. Make sheet metal installations weathertight at all locations.
2. Provide expansion and contraction joints at not more than 40-foot intervals, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing, provide an additional joint. Where expansion and contraction joints are exposed to view, their location is subject to the Architect's approval.
3. Exposed surfaces shall be free from visible wave, warp, and buckle.

I. Flexible flashing: Install under all parapet caps. Lap joints 2-inches. Carry flexible flashing down wall as far as the edge of the coping; overlap wall weather barrier at least 2-inches.

J. Install curbs and gravity roof vents level and square with tight, waterproof joints; attach securely to deck.

K. Completed flashings and sheet metal work shall be watertight, free of tool marks, dents, scratches and other damages, with joints and corners accurately machined, filed and fitted, and rigidly framed together and connected. Non-complying work shall either be repaired, when repairs are acceptable to the Architect, or replaced with new, undamaged flashings and sheet metal work.

END OF SECTION

SECTION 07 84 00 – PENETRATION, JOINTS & PERIMETER FIRE BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: firestop systems consisting of a material, or combination of materials installed to maintain the integrity of the fire-resistance rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations, blank openings, construction joints, or at the gap created at the building perimeter of the horizontal fire resistance rated assembly and non-fire-resistance rated exterior wall and in or adjacent to either fire-resistance or non-fire-resistance rated barriers in accordance with Authorities Having Jurisdiction (AHJ) requirements. Use firestop systems at locations including, but not limited to, the following:

1. Protected openings including both empty openings and openings that contain penetrations.
2. Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain penetrations.
3. Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
4. Joints in fire-resistance-rated assemblies that to allow independent movement.
5. Perimeter of the horizontal fire-resistance rated assembly and exterior wall between a rated floor/roof and an exterior wall assembly that is not fire-resistance rated.
6. Joints, through penetrations and membrane penetrations in Smoke Barriers, Smoke Partitions and those assemblies required to limit, restrict or retard the passage of smoke.

B. Related requirements: Divisions 07 and 09 for all other sealants.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data and installation instructions for materials and prefabricated devices.

B. Shop Drawings: Large scale Drawings indicating materials, installation methods, and interfaces with adjoining construction for each penetration firestop system.

1. Include qualified testing and inspecting agency’s penetration firestop design designation evidencing compliance with requirements for each condition indicated.
2. Include qualified testing and inspecting agency’s applicable illustrations showing each penetration firestop configuration at every construction assembly penetrated for each type of penetrating item.
3. Where Project conditions require modification of qualified testing and inspecting agency's tested assembly to suit a particular penetration firestop condition, obtain acceptance of AHJ for the modification prior to submitting Shop Drawings.

C. Test reports: Certified laboratory test report demonstrating the material or combination of materials proposed for use meets the requirements specified in ASTM E 814, are so classified in UL Building Materials Directory and are approved by the AHJ.

D. Certificates: Product certificates signed by firestopping product manufacturers certifying their products comply with specified requirements.

E. Documentation

1. Provide details of installations, with Listed Systems and/or EJ/EFRRA's and locations on Life Safety Drawings for restoring the fire resistance rating or smoke resistant properties where a breach in an assembly occurs for a fire-resistance rated joint, penetration and/or safing slot, perimeter interior fire containment system.
2. Deliver such documentation as a binder, electronic or software application/program to the Architect at the end of construction.
3. Make this information part of the closeout documents.

1.3 QUALITY ASSURANCE

A. Uniformity: Obtain firestopping materials and components from a single manufacturer for each kind of penetration and construction condition indicated. Do not mix manufacturer's materials in the same assembly
B. Compatibility: Provide firestop systems compatible with one another, and with the assemblies into which they are installed.
C. Regulatory requirements: Materials proposed for use shall be approved by the AHJ for their intended use.
D. Installer's qualifications:

1. FM-approved in accordance with FM 4991 – Standard for the Approval of Firestop Contractors, or.
2. UL Qualified Firestop Contractor, and,
3. Firestop Contractors International Association Contractor Member in good standing.
4. Licensed by AHJ, where applicable.
5. Shown to have successfully completed not less than 5 comparable scale projects

E. Special Inspectors credentials: Special Inspectors with experience in the same type and complexity of work inspected. In addition, both with the competence and experience shall be acceptable to the AHJ.
F. Repairs: Provide a narrative that lists materials to be used and clearly explains repairs procedures to maintain the safing capabilities of the assemblies.

PART 2 - PRODUCTS

2.1 HANDLING

A. Store materials to prevent deterioration or damage.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Penetrations: Provide firestop products that when installed to the tested and listed system or engineering judgment (EJ)/equivalent fire-resistance rated assembly (EFRRA) to become firestop systems or EJ/EFRRA's produced to resist the spread of fire, and/or the passage of smoke through breaches, gaps, openings, in fire-resistance-rated and smoke-resistant assemblies according to requirements indicated, including but not limited to the following.

1. Firestop all breaches made in fire-resistance rated assemblies for penetrating items passing through fire-resistance-rated wall and floor assemblies and other locations as indicated on the Drawings.
2. Provide complete penetration firestopping systems tested and approved by a nationally recognized third-party testing agency to the listing and the manufacturers installation instructions.
3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined through testing in accordance with ASTM

E 814 or UL 1479, but not less than one hour or the no less than the fire-resistance rating of the construction assembly being penetrated by the penetrating item.

4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T (temperature) ratings, in addition to F ratings, as determined per ASTM E 814 or UL 1479, where indicated and required by the applicable Building Code. T-rated assemblies are required where the following conditions exist.

    a. Where firestop systems protect floor penetrations located outside of wall cavities.
    b. Where firestop systems protect floor penetrations located outside fire-resistive shaft enclosures.
    c. Where firestop systems protect penetrations located in fire-resistive construction that have doors required to have a temperature-rise rating.
    d. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 square inches in overall cross-sectional area.

5. L – Rated Through-Penetration Firestop Systems: Provide firestop systems with Air Leakage (L) ratings, in addition to F and T ratings, as determined in accordance with UL 1479, where indicated.
6. Fire-resistive joint sealants: Provide joint sealants with a fire-resistance rating, determined in compliance with ASTM E 119, equaling or exceeding the fire-resistance rating of the construction penetrated but not less than one hour.

B. For firestopping exposed to view, traffic, moisture, or physical damage: Provide products that will not deteriorate when exposed to these conditions.

1. For plumbing and wet-pipe sprinkler system piping penetrations provide moisture-resistant penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches or more in any dimension, and for penetrations exposed to possible loading and traffic: Provide penetration firestop system capable of supporting the floor load involved without damage to the firestop system.
3. For penetrations with insulated piping: Provide penetration firestop systems not requiring removal of piping insulation.

C. For firestop exposed to view: Provide products with a flame-spread rating of than 25 or less and a smoke-developed value of 450 or less, as determined in compliance with ASTM E 84.

2.3 MANUFACTURERS

A. Provide materials from one or a combination of the following, as selected by the installer, depending on the condition of use:

1. 3M Fire Protection Products.
2. Graber Construction Products.
3. Hilti Construction Chemicals, Inc.
4. STI Firestop.
5. Specified Technologies, Inc.
6. Tremco Inc.
7. Emseal Joint Systems Ltd.
8. Rectorseal/CSW Industrials

2.4 MATERIALS

A. Ceramic-fiber and mastic coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
B. Ceramic-fiber sealant: Single-component formulation of ceramic fibers and inorganic binders.
C. Endothermic, latex compound sealant: Single-component, endothermic, latex formulation.

D. Intumescent, latex sealant: Single-component, intumescent, latex formulation.
E. Intumescent putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
F. Intumescent wrap strips: Single-component, elastomeric sheet with aluminum foil on one side.
G. Job-mixed vinyl compound: Prepackaged vinyl-based powder product for mixing with water at the Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at the Project site to form a non-shrinking, homogenous mortar.
I. Pillows/bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
J. Silicone foam: 2-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.
K. Silicone sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant.
L. Solvent-release-curing intumescent sealant: Solvent release curing, single-component, synthetic polymer based sealant.
M. Color: Where firestopping/firesafing material is exposed to view, provide material color selected by the Architect from the manufacturer's palette, unless the material will be field painted.

2.5 ACCESSORIES

A. Provide accessories as required to install fill materials and complying with the system description above.

1. General: As specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistive assembly.
2. Permanent forming/damming/backing materials:

a. Semi-refractory fiber (mineral wool) insulation.
b. Ceramic fiber.
c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
d. Fire-rated form board.
e. Joint fillers for joint sealants.

3. Temporary forming materials:

a. Substrate primers.
b. Collars.
c. Steel sleeves.

2.6 MIXING

A. For products that require field mixing prior to application, comply with firestopping manufacturer's directions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which penetration firestop systems will be installed.
B. Verify that surfaces to be in contact with firestopping materials are clean of dirt, grease, oil, loose materials, rust, and other substances that may affect proper fitting or the required fire resistance.

C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. General: Install materials in conformance with their manufacturer's instructions and to comply with UL Fire Resistance Directory.
B. Surface cleaning: Clean openings and joints immediately prior to installing firestopping in accordance with the recommendations of firestopping manufacturer and the following:

1. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping materials.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by the firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
D. Masking tape:

1. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials.
2. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 PENETRATION FIRESTOP SYSTEMS

A. Forming/damming materials and accessories:

1. Install as required to support fill materials during their application to produce the cross-sectional shapes and depths required to achieve fire ratings of firestop systems.
2. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

B. Install fill materials for penetration firestop systems to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIRE-RESISTIVE JOINT SEALANTS

A. Install joint fillers to provide support of sealants during application, produce the cross sectional shapes and depths of installed sealants for optimum sealant movement capability, and develop fire-resistance rating required.
B. Install sealants so they will directly contact and fully wet joint substrates. Completely fill recesses provided for each joint configuration, and provide uniform, cross- sectional shapes and depths relative to joint width. Install sealants at the same time joint fillers are installed.
C. Tool non-sag sealants immediately after sealant application and before skinning or curing begins; form smooth, uniform beads. Eliminate air pockets to ensure contact and adhesion of sealants with sides of joint.

1. Remove excess sealant from surfaces adjacent to joint.

2. Do not use tooling agents that will discolor sealants or adjacent surfaces, or that are not approved by the sealant manufacturer.

3.5 FIELD QUALITY CONTROL

A. Examine penetration firestop systems to ensure proper installation prior to concealing or enclosing firesafed and firestopped areas.
B. Repair damaged areas and restore the integrity of the assembly.
C. Keep areas of work accessible until inspection and approval by applicable authorities having jurisdiction.

3.6 CLEANING

A. Cleanup spills of liquid components.
B. Cut and trim excess materials neatly, flush with adjacent surfaces.

3.7 ON SITE FIRESTOP IDENTIFICATION SYSTEMS:

A. (Optional) Wall and floor identification system, shall be permanent, affixed, labels made that self-destruct upon removal, consisting of paper, metal or ceramic fiber materials, or hanging tags in accordance with FCIA Recommended Professional Practice RPP-L-2018-1, for the Identification of Fire-Resistance Rated and Smoke Resistant Penetration and Joint Firestopping. The firestop system identification device shall be located within 6” of the firestop system edge, each side of the wall, accessible side of horizontal assemblies, in or out of view. Firestop identification systems shall be installed as each firestop system is completed. Firestop Identification system shall have the following minimum information:

1. The words – “Warning - Firestop System – Do Not Remove or Tamper”
2. UL or other laboratory tested and listed system number.
3. Date of Installation.
4. Installing subcontractor Company name, contact information.
5. Manufacturer Company Name
6. Installing Individual Identifier
7. Fire Resistance Rated Assembly Markings
8. Provide identification for all vertical fire resistance rated and smoke resistant assemblies.

a. Identification markings: Adhesive tamper evident stickers, stencil painted with lettering at least 3 inches high with a minimum 3/8-inch stroke in contrasting color.
b. Marking to incorporate the assembly’s fire-resistance rating and the type of assembly that the wall is. Examples below are from the IBC and NFPA:

1) Fire Barrier – DO NOT BREACH - PROTECT ALL OPENINGS.
2) Smoke Barrier – DO NOT BREACH - PROTECT ALL OPENINGS.
3) Fire Wall – DO NOT BREACH - PROTECT ALL OPENINGS.
4) Fire Partition – DO NOT BREACH - PROTECT ALL OPENINGS.
5) Smoke Partition – DO NOT BREACH - PROTECT ALL OPENINGS.

END OF SECTION

SECTION 07 92 00 - JOINT SEALERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements pertaining to all sealants required for the Project (except as specified below and becomes an integral part of all Sections containing references to this Section, as well as all locations where sealants are indicated on the Drawings and required to make the building weathertight.

B. Section also includes sealants for interior joints in vertical applications, where required to close gap between different materials (paintable and non-paintable), and horizontal traffic surfaces as follows:

1. Control and expansion joints on exposed interior surfaces of exterior walls.
2. Perimeter joints of exterior openings.
3. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
4. Tile control and expansion joints.
5. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
6. Joints on underside of precast concrete beams and planks.
7. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
8. Perimeter joints of toilet fixtures.
9. Other joints indicated.

C. In addition, the work of this Section also includes air sealing to supplement and provide continuity of main and primary air barrier assemblies, including sealing and/or filling perimeter of door and window openings, crevices, gaps, cracks in walls, roof/wall connections, mechanical and electrical penetrations in walls, floors, roofs, exterior glazed assemblies mullions, beams, columns enclosures and similar locations with foam to provide air barrier integrity and a permanent barrier against air infiltration and loss.

D. Section includes:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

   a. Control and expansion joints in cast-in-place concrete.
   b. Control and expansion joints in unit masonry.
   c. Control and expansion joints in Portland cement plaster.
   d. Joints between different materials listed above.
   e. Perimeter joints between materials listed above and frames of doors and glazed assemblies.
   f. Control and expansion joints in ceiling and overhead surfaces.
   g. Other joints as indicated and required to make the building weathertight.

2. Exterior joints in horizontal traffic surfaces as indicated below:

   a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
   b. Tile control and expansion joints.
   c. Joints between different materials listed above.
   d. Other joints as indicated and required to make the building weathertight.

3. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
    d. Tile control and expansion joints.
    e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    g. Perimeter joints of toilet fixtures.
    h. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:

    a. Control and expansion joints in cast-in-place concrete slabs.
    b. Control and expansion joints in tile flooring.
    c. Other joints as indicated.

E. Related requirements:

1. Division 03 for preformed compressible expansion joint fillers for concrete slabs.
2. Division 07 for firestopping sealants.
3. Division 08 for storefronts and glazing sealants.
4. Division 09 for acoustical sealants.
5. Division 23 for duct sealants.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Pre-installation meeting:

1. Prior to start of installation of exterior vertical sealants, arrange a pre-installation meeting between the sealant manufacturer authorized representative, the Contractor, the installer , and the Architect to review conditions of surfaces to be sealed, as well as other conditions that would affect the quality of this work, the Drawings and Specifications, and the sealant manufacturer’s data.
2. If more than one trade will be responsible for the successful performance of the work of this Section, these trades shall attend the meeting.
3. Review all typical and atypical details to verify the method of sealing joints that the Contractor will follow, as well as corrective actions that are required.
4. Special conditions not specifically referenced or addressed by the Project Drawings, manufacturer’s typical details, or the Shop Drawings, shall also be identified, reviewed and discussed.
5. Take photographs and notes of unresolved conditions, if any, along with sketches of the same unresolved conditions so that a determination can be made of actions to be taken to assure an installation that will be acceptable, watertight and acceptable to the sealant material manufacturer for issuance of the warranty.
6. Record meeting minutes and distribute PDF copy to all concerned, and the Architect, within 48 hours after the meeting.

1.3 DEFINITIONS

A. Substrates:

1. M type substrates: Concrete, concrete masonry units, brick, mortar, natural stone. The term "masonry" means brick, stone, and concrete masonry work.
2. G type substrates: Glass and transparent plastic glazing sheets.
3. A type substrates: Metals, porcelain, glazed tile, and smooth plastics.
4. O type substrates: Wood, unglazed tile; substrates not included under other categories.

1.4 SUBMITTALS

A. Data:

1. Manufacturer Product Data and published instructions for each type of sealant, backing, bond breaker, and other accessory materials, together with statement that the proposed materials comply with these Specifications.
2. Include manufacturers' recommendations for surface preparation and priming for all substrates to be in contact with sealant on the Project.

B. Certification: Sealant manufacturer certification that sealants, backing rods, and other materials proposed for use in the application of sealants, are chemically compatible with the materials which will come in contact with the sealants and will not cause deterioration, premature aging and staining of adjacent materials, or the sealants.

C. Test results: Results of adhesion and staining tests performed on same materials as those intended for use on the Project.

D. Samples: Cured Samples of the various types and colors of materials proposed for use, approximately 12 inches long, mounted on hardboard backing.

1.5 QUALITY ASSURANCE

A. Uniformity: All sealants used in or on the exterior walls of the building(**s**) shall be made by the same manufacturer.

B. Installer qualifications: Firm with a minimum 5 years of experience with joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

C. Color selection:

1. Final color selection of sealants to be used for exterior locations will be made by the Architect from job-applied Samples on in-place materials.
2. The Architect will select locations and extent of these Samples, but their lengths will not exceed 10 feet for vertical and horizontal joints of each sealant color.

D. Quality control by sealant manufacturer:

1. Submit statements on the manufacturer's letterhead, dated no earlier than one year prior to submittal, for tests listed below.
2. Test data more than a year old will be acceptable provided manufacturer states that formulations or manufacturing methods have not changed sufficiently to change test results.
3. Submit Samples of materials to be used for the Project to the manufacturer as required for tests.

4. Test methods: The following ASTM standards methods apply to sealants to be provided for the Project.

    a. C 794: Sealant compatibility and adhesion to each substrate to be encountered on the Project.
    b. Compliance with C 920 for elastomeric sealants. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (ASTM C 719), low temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
    c. C 1087: Sealant compatibility with backing.
    d. C 1087: Sealant compatibility and lack of adhesion to bond breaker.
    e. C 1184: Structural Glazing Specifications.
    f. C 1193: Guide for Use of Sealants.
    g. C 1247: Durability of sealants exposed to continuous water immersion.
    h. C 1248: Stain Test Method.
    i. C 1401: Guide for Structural Glazing.
    j. C 1472: Guide for Calculating Joint Movement.

5. Include identification of any special substrate cleaning process and required adhesion promoter or primer.

E. Preconstruction field testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows.

1. Locate test joints where indicated or, if not indicated, as directed by Architect.

    a. Each type of elastomeric sealant and joint substrate for exterior joints only.
    b. Each type of non-elastomeric sealant and joint substrate indicated.

2. Notify Architect one week in advance of the dates and times when mockups will be erected.
3. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
4. Test method: Test joint sealants by hand pull method described below:

    a. Install joint sealants in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
    b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2-inch cuts. Place a mark one-inch from top of 2-inch piece.
    c. Use fingers to grasp a 2-inch piece of sealant just above one-inch mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

5. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
6. Evaluation of field test results: Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 HANDLING

A. Store sealant containers in a protected location in compliance with their manufacturer's instructions until their use. Do not store at temperature higher than 80-degree F.

1.7 JOB CONDITIONS

A. Do not install sealants under adverse weather conditions, or when temperatures are beyond manufacturer's recommended limits.
B. Proceed with the installation only when forecasted weather conditions are favorable for proper sealant cure and development of early bond strength.

1.8 WARRANTY

A. Warrant sealants against defective materials and workmanship for the following length of time after Substantial completion:

1. Manufacturer:

a. Exterior vertical sealant: Manufacturer’s 20-year weatherseal warranty, including non-staining warranty for Dowsil 795 and 756 SMS.
b. All other exterior locations: Manufacturer’s 5 years weatherseal warranty.

2. Installer: 5 years labor and material warranty.

B. Warranty shall further state that installed sealants are warranted against the following:

1. Water leakage through exterior sealed joints.
2. Adhesive or cohesive failure of sealant.
3. Staining of adjacent surfaces caused by migration of sealants or primer.
4. Chalking or visible color change of the cured sealants.

C. Make repairs during the 5-year warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Exterior joint sealants are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, with recognized limitations of wear and aging as indicated for each application.

2.2 MANUFACTURER/TYPE - SEALANTS

A. Colors: Match sealant color to color of adjacent materials as closely as possible using colors selected from the manufacturer's standard palette, as approved by the Architect.
B. General:

1. Do not mix multiple component materials until required for use.
2. Use materials “as received” from manufacturer, without additions, deletions and adulterations of materials.
3. Do not use sealants that have started to cure and those whose shelf life expired.

C. Compatibility: Provide joint sealers, joint fillers and other related materials as follows:

1. That will not cause staining, degradation and premature aging of the adjacent surfaces and the sealant itself, when in contact with these surfaces.
2. Compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

D. Bulk sealants:

1. For interior slabs where heavy wheeled traffic will occur: One of the following.

a. L&M:

1) “Epoflex” (epoxy).
2) “Joint Tite” (urea).

b. Atlas “Epoxy Joint Filler.”
c. Nox-Crete:

1) “Dynaflex JF-85.”

d. VersaFlex, Inc.: SL Series (polyurea) as recommended by the manufacturer after surveying the conditions at the site.

2. For interior and exterior horizontal application subject to pedestrian or vehicular traffic: Single component silicone sealant.

a. Type and grade: S (single component) SL (self-leveling).
b. Class: 25.
c. Use related to exposure: T (traffic).
d. Uses related to joint substrates: M, A, and, as applicable to joint substrates indicated, O.
e. Products:

1) Dowsil; “888”” or “SL Parking Structure Sealant” (basis of design).
2) Pecora Corp.; “300 SL Pavement Sealant.”
3) Crafco Inc.; “RoadSaver Silicone SL.”

3. For all other exterior applications, except where stone occurs:

a. Type and grade: S (single component) and NS (nonsag), neutral- and basic-curing silicone sealant.
b. Class: 100/50.
c. Use related to exposure: NT (non-traffic).
d. Uses related to joint substrates: M, G, A, and, as applicable to joint substrates indicated, O.
e. Products:

1) Dowsil “795” (basis of design).
2) General Electric “Silpruf,” “Silpruf LM,” “Silpruf NB.”
3) Tremco “Spectrem 1.”

4. For stone joints where sealant will contact stonework (interior and exterior):

a. Type and grade: S (single component) and NS (nonsag), neutral- and basic-curing silicone sealant.
b. Class: 100/50.
c. Use related to exposure: NT (non-traffic).

d. Uses related to joint substrates: M, G, A, and, as applicable to joint substrates indicated, O.
e. Products:

1) Dowsil “756 SMS,” (basis of design).

a) Dowsil “795” may be used if tested on stone prior to final installation and no staining is observed.
2) General Electric “GE SC S9000 SMS.”
3) Tremco “Spectrem 3.”
4) Pecora “895 NST.”

5. For interior damp, wet and semi-wet locations, other than floors, such as toilet rooms where a mildew-resistant sealant is required: Provide white sealant, unless otherwise noted. Single-component mildew-resistant neutral-curing silicone sealant:

a. Type and Grade: S (single component) and NS (nonsag).
b. Class: 25.
c. Use related to exposure: NT (non-traffic).
d. Uses related to joint substrates: M, G, A, and, as applicable to joint substrates indicated, O.
e. Products:

1) Dowsil. “786” basis of design.
2) Pecora Corp. “898.”
3) General Electric Corp. “1700.”

6. For all other interior applications (paintable sealant): Latex sealant complying with ASTM C 834, Type P, Grade NF.

a. Pecora Corp. “AC-20+.”
b. Schnee-Morehead, Inc. “SM 8200.”
c. Sonneborn, Division of ChemRex Inc. “Sonolac.”
d. Tremco “Tremflex 834” or “Acrylic Latex 384.”

7. Acoustical sealant:

a. Pecora Corp. “BA-98.”
b. US Gypsum Co. “Sheetrock Acoustical Sealant.”
c. Tremco, Inc. “Acoustical Sealant.”
d. WW Henry Co. “Henry 313.”
e. Or equal.

E. Tape sealants: American Saint-Gobain “Norseal 730” or “Norseal 770,” or equal by Pres-On Tape & Gasket Corp. or Schnee-Morehead.

2.3 ACCESSORY MATERIALS

A. Sprayed polyurethane foam sealant: One- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 pcf density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
B. Joint cleaner, primer and sealer: As recommended by the sealant manufacturer, for the surfaces to be cleaned, primed or sealed.
C. Bond breaker tape:

1. Polyethylene or other plastic tape recommended by the sealant manufacturer to prevent 3-sided adhesion where backer rod cannot be used, except for non-moving joints.

2. Use self-adhering tape wherever possible.

D. Backer rod:

1. General: Provide size, density and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.
2. Type: ASTM C 1330, of type indicated below:

    a. Type C: Closed-cell material with a surface skin, Nomaco “SOF ROD/Dual Rod,” or equal.
    b. For sealant in vehicular traffic areas, provide solvent-resistant backer rods, Nomaco HBR/Green Rod, or equal.
    c. For fillet and cove joints, Nomaco “HBR” 1/4-inch Round.”

3. Elastomeric tubing sealant backings:

    a. Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26-degree F.
    b. Provide products with low compression set.

4. In paving subject to traffic: Provide hard joint filler such as cork; prevent 3-sided adhesion by using bond breaker tape.

E. Masking tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 JOINT PREPARATION

A. Clean-out joints immediately before installing sealants to comply with recommendations of joint sealant manufacturer and the following.
B. Remove foreign material from joint substrates that could interfere with adhesion of sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer),oil, grease, waterproofing, water-repellents, water, surface dirt, and frost.
C. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

    1. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

D. Remove laitance and form release agents from concrete.

E. Clean metal, glass glazed surfaces of ceramic tile, and other non-porous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
F. Do not proceed with sealant installation over surfaces that have been painted, waterproofed or treated with water-repellent or other coating unless specifically approved in writing by the sealant manufacturer.
G. Use masking tape or other protection to limit coverage of sealant to joints to be sealed. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Comply with sealant manufacturer's instructions and ASTM C 1193, except where more stringent requirements are specified herein. At the Architect's option, ASTM C 1193 may also be used for rejection of unacceptable installations.
B. Prime or seal surfaces when recommended by the sealant manufacturer; when the manufacturer's instructions on priming are optional, prime the surface. Do not allow primer/sealer to spill or migrate onto adjacent surfaces.
C. Install backer rod for all sealants, except (1) for exterior sealants subject to traffic (verify that joint filler in paving is installed at the proper depth), (2) where the size of joint prevents the insertion of a backer rod, and (3) where recommended otherwise by the sealant manufacturer.

1. Install backer rods with blunt or rounded tools to avoid puncturing the material.
2. Do not twist, stretch or braid the backer rod.

D. Install bond breaker tape where space limitation does not permit use of a backer rod.
E. In no case shall sealant have 3-sided adhesion, except for non-moving joints.
F. Employ only proven installation techniques that will ensure that sealants are installed in uniform, continuous ribbons without gaps or air pockets and with complete "wetting" of the rabbet surfaces equally on opposite sides.

1. Fill concave joints to the configuration shown on Figure 8A of ASTM C 1193.
2. Provide flush joints to the configuration shown on Figure 8B of ASTM C 1193.
3. Provide recessed joints configuration as shown on Figure 8C of ASTM C 1193, unless otherwise indicated or required to match adjacent non-moving joint.
4. Where horizontal joints occur between horizontal and vertical surfaces, fill joints to form a slight cove to prevent trapping moisture and dirt.
5. Immediately after sealant application and prior to beginning of skinning or curing, tool sealant using tooling agents that will not discolor sealants or adjacent surfaces and are approved by sealant manufacturer.

G. Do not allow sealant or other compound to overflow, spill or migrate into voids of adjacent construction.
H. Remove excess sealant spillage promptly as this work progresses. Clean adjacent surfaces by recommended means to remove sealant, but not damage the surfaces.

3.4 CURING/PROTECTING

A. Cure sealants in compliance with their manufacturer's instructions to obtain high early bond strength, internal cohesive strength and durability.
B. Protect sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

END OF SECTION

SECTION 07 95 00 – EVA SEISMIC JOINT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. The waterproof system utilizes closed cell, cross-linked, ethylene vinyl acetate copolymer, nitrogen-blown rubber seals epoxy bonded to the structural opening.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Preinstallation meeting: Conduct a pre-construction meeting to discuss joint gap construction, joint width settings and construction phasing.

1. This meeting shall be held prior to any concrete placement at expansion joint locations and may be held in conjunction with the concrete pre-pour meeting.
2. Attendees to include manufacturer's Representative, all trades involving adjacent substrates, seismic joint cover subcontractor and Architect.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for each type and profile of assembly, including material list, finish, and test results for fire-rated assemblies.
B. Shop drawings: Supplement data with Shop Drawings showing the following.

1. Joint system schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

    a. Manufacturer and model number for each joint system.
    b. Joint system location cross-referenced to Drawings.
    c. Loads used in design of the floor joint systems.
    d. Nominal joint width.
    e. Movement capability.
    f. Classification as thermal or seismic.
    g. Materials, colors, and finishes.
    h. Materials, colors, and finishes.
    i. Product options.

C. Layout Drawings:

1. Placement drawings showing line diagrams for the entire route of each joint system, in plan, elevation, and section, full size details, splices, blockout requirement, and attachments to other work.
2. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
3. Show and identify fasteners and anchors to be embedded in concrete, dimensioned location, setting-out dimensions and acceptable setting tolerances.
4. Details of each type of embedded anchor required for the work of this Section.
5. Identify areas of the building to which the work of this Section is attached with embedded anchorage, as well as areas of the building to which the work of this Section will be attached without the use of embedded anchorage.

D. Samples:

1. For each joint, complete assembly of each type. Include prototype units for custom fabrication.
2. Each color and finish selected. Include custom colors.
3. Representative transition and corner fitting fabrications to confirm quality of work as a standard for work on the Project.

E. Certificates: Certificates, research report number, or other proof that assemblies used in fire-rated construction are approved by the authorities having jurisdiction for the conditions of use.

F. Installer's certificate by manufacturer.

1.4 QUALITY ASSURANCE

A. Installer shall be certified by manufacturer to install this system.

B. Elevation Tolerance – surface areas two feet on each side of the expansion joint opening shall be finished and graded perpendicular to joint opening creating flush slab-to-slab transition. Elevations on each side shall be identical.

C. Single source responsibility: Provide all components for each assembly from one manufacturer.

1.5 HANDLING

A. Deliver products to site in Manufacturer's original, intact, labeled containers and store under cover in a dry location until installed. Store off the ground in temperatures above 40ºF, protect from weather and construction activities.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide watertight expansion joint sealing system that meets the specified movement requirements and is capable of accommodating vehicular and pedestrian traffic.

B. System shall consist of a continuous ethylene vinyl acetate foam rubber seal profile. To ensure a watertight seal, the seal shall have ribbed sidewall profiles through which a thixotropic epoxy paste adhesive bonds the seal to the structural concrete joint opening.

C. Select the system size at each joint location based on the movement and design requirements that meet the project specification or as defined by the structural engineer of record. Ensure that the anticipated service condition is part of the expansion joint system selection criteria.

D. The Certified Contractor must provide written confirmation utilizing manufacturer's product data that the expansion joint seal selected will comply with and accommodate expansion and contraction throughout the full movement cycle.

2.2 MANUFACTURERS

A. One of the following, or equal:

1. Furnish approved Ethylene Vinyl Acetate Foam Sealing System "EVA Series" as manufactured by MM Systems Corporation, basis of design.
2. EMSEAL Joint Systems, Ltd.
3. Willseal LLC.
4. Watson Bowman Acme Corp.
5. Or equal.

2.3 PERFORMANCE REQUIREMENTS:

A. Joint assemblies shall permit unrestrained movement of joint without disengagement of and, where applicable, remain watertight and maintain the fire-rated protection of the adjacent assemblies.
B. Provisions for movement of the structure:

1. The building is in the Seismic Design Category (SDC) indicated, as defined by the CBC. Install joint assemblies requiring special bracing or mounting to meet seismic movements for the SDC indicated.
2. This work shall be engineered, detailed, and installed to accommodate dead load and live load deflection, thermal expansion, creep, sway, drift, and torsion of the structure as may be anticipated by seismic and other conditions. Live loads used in design shall be the same as adjacent floor with the highest live load.
3. Identify on the Shop Drawings the amount of movement that is accommodated in the engineering and details.

2.4 MATERIALS

A. EVA Series Rubber Seal – shall be a flexible, closed-cell cross linked ethylene vinyl acetate copolymer nitrogen-blown rubber exhibiting the physical properties listed below.

PHYSICAL PROPERTIES OF ETHYLENE VINYL ACETATE FOAM SEAL

Property	Requirement	ASTM Method
Tensile Strength	115 psi +/- 25%	D3575/T
Tear Resistance	15 lbs./inch +/- 20%	D624
Elongation Break	55% +/- 25%	D3575/T
Compression Set	50% for 22 hrs. @ 73°F/23□C 9% set 24-hour recovery	D3575/B
Compression Recovery	No Deterioration 50% for 22 hrs. @ 73°F/23□C 0.5-hour recovery	AASHTO T42
Density, average	2.7 - 3.2 (lbs./cu.ft.)	D3575
Water Absorption (by weight)	<0.02 (lbs./sq.ft.)	D3575
Ozone Resistance	No Cracks	D1149
UV Resistance	Very Good	

1. Model Number EVA-500.

a. Total Movement: 4.25-inches.
b. Installation width: 5.009 - 6.275 inches.

B. Epoxy Adhesive – provide manufacturer's high strength aggregate reinforced epoxy adhesive consisting of liquid components "A" and "B" with a one to one mix ratio.
C. Accessories: Manufacturer's standard spacers, flexible vapor seals and filler materials, drain tubes, adhesive, and other accessories compatible with material in contact.

2.5 FABRICATION

A. EVA Series Rubber Seal – ship in the longest practical stick length packaged in cartons or on wooden pallets.
B. Epoxy Adhesive – Ship in manufacturer's approved containers and packaged in cardboard cartons.

2.6 FINISHES

A. EVA foam rubber seal shall be supplied in standard color: grey.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pre-installation Inspection – the General Contractor, manufacturer's representative and certified contractor, will conduct a pre-installation project site inspection. Provide a field report that summarizes the project conditions and any remedial action necessary to correct field conditions (substrate, joint size, non-parallel sidewalls, vertical offsets, etc.) that may affect expansion joint system performance.
B. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Contractor shall provide properly formed expansion joint openings constructed to the exact dimensions and elevations shown on manufacturer's standard system drawings or as shown on the contract drawings. Any edge or area in need of repair shall utilize structural concrete repair materials that provide a solid and square expansion joint opening.
B. Contractor shall insure that the joint opening sidewall interfaces run parallel to each other for the entire length of the joint. Sidewalls should be plumb and interfaces must be continuously equidistant from each other across the joint width to accommodate the proper installation of the expansion joint sealing system.
C. Contractor shall clean the joint opening of all contaminants by abrasive blasting immediately prior to installation of the joint system. Concrete form release agents, water repellents, laitance, surface dirt, rust, old sealants and other protective coatings are examples of materials that must be removed from the joint opening substrate in order to obtain the proper bond.
D. Areas adjacent to the joint must be masked with tape to assure neat, clean joint lines. (Remove tape prior to the curing process.)
E. Concrete must be completely dry and fully cured (28 days where the concrete has a moisture content that is below 4%) prior to placement of the expansion joint system. Joint openings requiring the use of structural repair material must be cured for 72 hours prior to joint system placement.
F. Cracks in areas adjacent to the joint must be repaired per the joint manufacturer's recommendations.

3.3 INSTALLATION

A. Comply with the joint assembly manufacturer's instructions.
B. Match EVA seal sizes to corresponding joint widths along the length of the joint run.
C. The two components of the epoxy adhesive (part A – white and part B – black) shall be thoroughly mixed until uniformly blended to a consistent gray color.
D. Apply the epoxy adhesive per the manufacturer's instructions to the joint opening interfaces and to the ribs of the seal. The ribs must be completely filled.
E. Insert seal into the joint opening with glove covered hands. Utilize blunt installation tool to properly position the seal.
F. Clean all excess adhesive around the edges and top of the joint with a trowel or scraping tool.
G. Important - Allow epoxy adhesive to cure (usually 24 hours). All seals must be installed in a state of compression.

3.4 CLEAN AND PROTECT

A. Protect the system and its components during construction. Heavy construction vehicles will not be permitted to cross the expansion joint. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION

DIVISION 08
OPENINGS

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Flush steel doors.
2. Stile and rail full louvered steel doors.
3. Transom panels.
4. Steel door and window frames, including sidelights and transom panels.
5. Louvers and vision panel frames in steel doors.

B. Work furnished but installed in other Sections: Division 04 for building-in of anchors and grouting of frames in masonry.

C. Work installed but furnished in other Sections: Division 08 for finish hardware.

D. Related requirements:

1. Division 08 for access panels and frames, glazing vision panels in steel doors, and glazing steel windows.
2. Division 09 for finish painting the work of this Section.
3. Division 14 for elevator doors and frames.

1.2 REFERENCES

A. SDI 117, Manufacturing Tolerances Standard Steel Doors and Frames.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:

B. Pre-installation meeting:

1.4 SUBMITTALS

A. Shop Drawings: Show the following.

1. Door and frame elevations, materials, construction, gage, finish, anchoring for each wall condition, conditions of openings, vision panel and louver sizes and locations, and accessories.
2. Location and size of reinforcement for finish hardware.
3. Locations of field splice joints, including associated details to assure proper assembly at Project site.
4. Identify work that cannot be permanently factory-assembled before shipment.
5. Details of removable stops, and glazing.
6. Details of conduit and preparations for power, signal, and control systems in doors and frames.
7. Use same reference numbers for openings and details as shown on Contract Drawings.

B. Schedule: Door schedule indicating opening identification symbol, door and frame types, sizes, including thickness, swing, label requirements, louvers, vision and transom panels, and undercuts.

C. Samples:

1. Twenty-four-inch square Sample of door illustrating typical head, bottom and jamb conditions, cutouts for hinge, lock/latch and magnetic contact, and vision panel centered in sample.
2. Frames showing profile, welded corner joint, welded hinge reinforcement, dust cover boxes, floor and wall anchors, and silencers. Include panel and louver sections and glazing stops where applicable.

D. Data: Manufacturer or fabricator Product Data for doors, frames and shop primer**,** and louvers.

1.5 QUALITY ASSURANCE

A. Uniformity: Provide all steel doors and frames for the Project made by a single firm, unless otherwise acceptable to the Architect.
B. Regulatory requirements:

1. Fire-rated doors shall be listed by a nationally recognized testing and certification agency acceptable to AHJ. The listed doors shall meet or exceed the requirements of UL10B, NFPA 252 and NFPA 80. Doors shall carry either a UL or ITS (Intertek Testing Services-Warnock Hersey) label.
2. Comply with CBC requirements. Provide tested products that passed, as an assembly, the CBC Standard 7-2 positive pressure smoke testing requirements.
3. Comply with ASTM E 2074, Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure on Side-Hinged and Pivoted Swinging Door Assemblies.
4. Doors in exit enclosures shall bear an “S” label.

C. Oversize fire-rated door assemblies: For units exceeding sizes of tested assemblies, provide a label or a certificate of inspection, by a testing agency acceptable to AHJA, that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

1.6 HANDLING

A. Procedure: In accordance with SDI recommendations.
B. Packing: Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
C. Delivery:

1. Inspect doors, frames, and accessories delivered to the site for damage. Unload and store, as specified, with a minimum of handling.
2. During delivery, provide temporary steel spreaders securely fastened to the bottom of each frame.
3. Replace doors and frames damaged before installation. Do not install damaged doors and frames.

D. Storage:

1. Store doors and frames carefully under cover. Provide a minimum of 1/2-inch space between doors. Do not stack doors and frames.
2. The storage spaces shall be dry and accessible, adequately ventilated and free from dust or water, and shall permit easy access for inspection and handling.
3. Do not use non-vented plastic or canvas shelters that create a humidity chamber.
4. If doors are shipped with fiberboard wrapper and it becomes wet, remove it immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. One of the following, or equal:

1. Door Components, Inc.
2. CECO.
3. Curries Co.
4. Security Metal Products.
5. Steelcraft Manufacturing Co.
6. Stiles Hollow Metal.

2.2 MATERIALS

A. Cold rolled steel: ASTM A 1008, “Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability” and A 568, “Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.”

B. Hot rolled, pickled and oiled steel: ASTM A 1011, “Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability” and A 568, “Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.”

C. Hot dip zinc coated steel: Alloyed type complying with ASTM A 924, “Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process” and A 653, “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.” The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 oz/ft² total both sides, i.e., A40 (ZF120). Comply also with SDI-112 “Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames”.

1. When zinc-coated steel is specified for anchors and accessories, and electrolytically deposited zinc coated steel is provided, it shall comply with ASTM A 591, “Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight Applications.” The minimum coating weight shall be a class “B”, i.e., 0.075 oz/ft².

    a. Coated steel sheets: ASTM A 653, QC classification, with a G60 or A60 zinc coating, mill-phosphatized.

2. Inserts, bolts and fasteners: Manufacturer standard units, except hot-dip galvanize all items in exterior walls.

D. Paints:

1. Shop primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A250.10, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames", and compatible with finish paint system specified in Section 09 90 00.
2. For touchup of damaged galvanized surfaces: SSPC Paint No. 20, Type II (Organic) zinc -rich primer by Tnemec, Porter International, Valspar Corp., Ameron Protective Coatings or DuPont Co.
3. For back-coating frames: 3M Undercoating Black 08881, or fibrous asphaltic compound.

E. Door filler: In compliance with SDI 250.8, except use UL-listed materials in fire-rated doors.

2.3 FABRICATION - GENERAL

A. Do not begin fabrication until the fabricator has received the hardware schedule approved by the Architect and submitted by the hardware supplier.
B. Fabricate work to required profiles by roll-forming, brake-forming and welding to produce hollow metal work with straight and square edges, with surfaces free from warp, wave, buckle, oil-canning and other defects.
C. Fabricate without grind marks, hollow or other out-of-plane areas, holes, burned-out spots, weld build-up and other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.
D. Comply with SDI 250.8 and SDI 117, Manufacturing Tolerances Standard Steel Doors and Frames, except for the following:

    1. 0.005-inch in 3-inch span anywhere on the exposed surfaces. Fill depressions with Bondo or other automotive type filler. Sand bumps down, flush with adjacent surfaces.

E. Conform to AWS standards for welding. Face weld frames with exposed welds ground flush and smooth with parent metal. Welded joints shall be invisible after assembly is painted.
F. Fabricate doors, frames and sidelights at the following locations from coated steel; garage, assemblies in exterior walls, toilet rooms and shower rooms. Elsewhere, fabricate doors and frames from coated or uncoated steel.
G. Finish hardware preparation:

    1. Prepare doors to receive finish hardware, including cutouts, reinforcement as specified below, mortising, drilling, and tapping in compliance with templates provided by hardware supplier.
    2. Reinforce doors to receive hardware; provide internal reinforcement of sufficient size to avoid the use of through bolts that are not permitted. Drilling and tapping for surface-applied hardware may be done at Project site.
    3. Provide 16-gage (0.053-inch) stainless steel reinforcement for pull plates and bars. Provide internal reinforcement for closers on all door frames. Thru bolts (Chicago fasteners) are not permitted.
    4. Locate finish hardware as accepted on final Shop Drawings.

H. Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames. Surface-applied (adhesively-applied) stops are not allowed.
I. Provide minimum 26-gage (0.0179-inch) steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
J. Steel members shall be pre-straightened, free of wind or twist. Factory-align to a diagonal tolerance of plus or minus 1/16-inch.

2.4 FLUSH DOORS

A. Standards: Comply with the following, except as specified. Note that the following applies to swinging doors; for sliding doors, assemble and finish the doors same as the swinging doors, except that the doors shall comply with Level 3 (Extra Heavy Duty, Performance Level A).

    1. SDI 250.8, Specifications for Standard Steel Doors and Frames (SDI-100).
    2. SDI 117, Manufacturing Tolerances for Standard Steel Doors and Frames.
    3. SDI 118, Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements.

B. Steel doors:

1. SDI Level 2 and Physical Performance Level 2 and Physical Performance level B (Heavy Duty), Model 2 (Seamless), 18-gage (0.042-inch) for doors up to 3-foot wide, and Level 3 and Level 3 Extra Heavy Duty, Performance Level A, model 2 (Seamless), 16-gage (0.053-inch) for doors wider than 3 feet Provide doors with seamless welded edges ground to be invisible from adjacent surfaces; do not use Bondo or similar material to close gap between face sheets at door edge.
2. Close the top and bottom of doors with an inverted flush channel, minimum thickness of 0.042-inch thick.
3. Close openings for vision panels and louvers with an inverted flush channel, minimum thickness of 0.042-inch thick.
4. Insulate exterior doors to provide a U factor of 0.24 BTU/hr. by square foot by degree F when tested in compliance with ASTM C 236.

2.5 STILE AND RAIL LOUVERED DOORS

A. Standard: Complying with SDI 250.8, Recommended Specifications Standard Steel Doors and Frames, Level 3 (Extra Heavy Duty, Performance Level A), except as specified.
B. Stiles and rails:

1. Minimum 14-gage galvanized steel.
2. Miter or butt door corners.
3. Internally-reinforce joints, then weld and grind smooth so that joints are invisible after painting.
4. Intermediate rails shall be butted and internally welded to door stiles.
5. Hardware reinforcements shall be specified in table 4 of table 5 of SDI 250.8.

C. Louver blades:

1. Not less than 18-gage galvanized steel sheet formed into stationary; weatherproof Zee shaped blades and U-shaped frames, not less than 1-3/8-inch thick.
2. Space louver blades not more than 1-1/2-inch o.c.
3. Assemble by welding continuously all joints and grinding welds so they will be invisible when the door is painted.
4. Provide removable insect screens on interior side of frame, consisting of 14 by 18 aluminum wire mesh in rigid, formed metal frame.

2.6 FRAMES

A. General:

1. Fabricate frames to the dimensions and profiles indicated in compliance with SDI 250.8, Specifications for Standard Steel Doors and Frames (SDI-100), except as noted.
2. Reinforce and miter corners, interlock and/or weld internally. Weld faces continuously and grind smooth.

B. Stand alone door frames: Fabricate with coped or mitered, fully welded corners of steel 2-gage heavier than door face in same opening, minimum 16-gage (0.053-inch), corners reinforced, mitered, interlocked and/or welded, and visible joints continuously welded and ground smooth; non-welded joints visible in the finish work are not permitted.
C. Integral windows, glazed transom panels, and sidelights frames: For door frames with integral sidelights and transom panels, fabricate of same gage as the door frame.
D. Stand alone window frames: Fabricate of 18-gage (0.042-inch) steel.

E. Windows and glazed sidelights and transom panels: Provide integrally-formed glass stops on security side of glazed assemblies, and removable glass stops on opposite side.

1. Size rabbet to fit glass thickness indicated.
2. Miter glass stop corners; square, butt joints are unacceptable.
3. Attach removable glass stops securely with countersunk oval head machine screws spaced equally and symmetrically at not more than 12 inches o.c. and 2 inches from corners.

F. Mullions and transom bars:

1. Closed or tubular mullions and transom bars where indicated.
2. Join mullions and transom bars at crossings and to jambs by butt-welding.
3. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
4. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

2.7 DOOR LOUVERS

A. V, Y or Z shaped louver blades formed of 18-gage (0.042-inch) sheet steel welded to surrounding frame set flush with both sides of doors, by Air Louvers, Inc., Airolite Co., Anemostat Products Div/Dynamics Corp. of America, or Ventilouver Co. Provide same shape louver blade (V, Y or Z) throughout the Project.
B. When installed in fire-rated doors provide UL labeled, spring-actuated louver blades activated by a fusible link, or Zero International “Advantage Intumescent AI” louvers.

2.8 VISION PANELS IN DOORS

A. Make cutouts for vision panels square and parallel with door edges.
B. Provide integrally-formed glass stops on security side of doors and removable glass stops on opposite side.

1. Size rabbet to fit glass thickness indicated.
2. Miter glass stop corners; square, butt joints are unacceptable.
3. Attach removable glass stops securely in place with countersunk oval head machine screws spaced equally at not more than 12 inches o.c. and 2 inches from corners.

2.9 WINDOWS AND SIDELIGHT FRAMES

A. Fabricate as specified for door frames.

2.10 FLUSH TRANSOM PANELS

A. Clearly mark door and associated transom panel to assist in installation.
B. Fabricate as specified for door in same opening, except for hardware blocking and preparation.
C. No visible fasteners allowed when panel is in place.

2.11 SHOP PRIMING

A. After assembly, clean and prepare steel surfaces by removing mill scale, rust, oil, grease, dirt, and other foreign materials before painting. For coated steel, comply with ASTM D 2092 and the primer manufacturer’s instructions.

1. Grind welds and fabrication marks flush and smooth with parent metal.
2. Fill depressions with metal filler before applying the shop primer.
3. Apply one or more coats of epoxy mineral filler to conceal spot welds.

4. Where zinc coating is damaged, touchup with zinc-rich primer.

B. Acid-etch galvanized surfaces before pretreating.
C. Apply shop primer, within time limits recommended by pretreatment manufacturer, to provide a smooth coat of even consistency and to produce a dry film thickness of not less than 1-1/2 mils.
D. Assemblies with visible spot welds before or after application of finish paint will be unacceptable.

2.12 BACK COATING FRAMES

A. For frames installed in concrete and CMU openings, and frames in contact with plaster, factory-coat surfaces that will be concealed after installation with the back-coating material specified applied in a uniform thickness, without holidays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, and will provide a solid anchoring surface for frames.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLING FRAMES

A. Set frames accurately in their scheduled locations, plumb, straight, square and rigid.

1. Comply with these Specifications, the Drawings; ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames, the approved Shop Drawings and UL tested procedures and NFPA 80 for fire-rated openings. When in conflict, the most restrictive provision applies.
2. Brace frames to prevent their displacement during erection of adjacent walls.
3. Coordinate the installation of built-in anchors for wall and partition construction with related trades. Refer to Division 04 for frames in CMU walls.
4. Provide 2 anchors at head of frames exceeding 42 inches in width for frames mounted in steel stud walls.
5. Provide 3/8-inch by 2-inch vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry, continuous boxed studs, or to other structural support at each jamb.

    a. Bend top of struts to provide flush contact for securing to supporting construction above.
    b. Provide adjustable wedged or bolted anchorage to frame jamb members in compliance with UL 63.

B. Frame anchors: 18-gage (0.0478-inch) galvanized steel.

1. CMU construction: Adjustable, flat, corrugated, or perforated, Tee-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Provide at least 3 anchors per jamb up to 7 feet high; 4 anchors up to 8 feet height; one additional anchor for each 24 inches or fraction thereof over 8-foot high.
2. Stud partitions: Insert “nail-on” type with notched clip to engage stud, welded to back of frames. Provide at least 4 anchors for each jamb for frames up to 90 inches high; 5 anchors up to 96 inches high; one additional anchor each 24 inches or fraction thereof over 96 inches. Attach jamb anchors to studs with a minimum of four 3/8-inch diameter self-tapping screws or bolts (2 per side).

3. In-place concrete or CMU: Anchor frame jambs with minimum 3/8-inch concealed bolts into expansion shields or inserts at 6 inches from top and bottom and 26 inches o.c., unless otherwise shown. Reinforce frames at anchor locations. Except for fire-rated openings, apply removable stop to cover anchor bolts unless otherwise indicated.

C. Provide UL-tested adjustable floor clips for all frames. Anchor clips to floor with powder-driven pins or bolts in expansion shields.
D. Leave frame spreader bars intact, wherever possible, until frames are set perfectly square and plumb and all anchors are securely attached and grouted where required.
E. Installation tolerances: Adjust door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

3.3 HANGING DOORS

A. Install finish hardware in compliance with its manufacturer's templates and instructions.
B. Hang doors in compliance with their manufacturer's instructions, and adjust to the clearances specified in SDI 250.8, except as specified below, as indicated on the Drawings, or as required by UL listing and NFPA 80 for fire-rated doors.
C. Do not install doors warped, bowed, dented or otherwise damaged.
D. Adjust hardware so that doors operate freely for their entire travel, but not loosely, without sticking or hinge binding, with hardware adjusted and functioning properly.
E. Fit doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-fire-rated standard steel doors:

a. Jambs and head: 1/8-inch plus or minus 1/16-inch.
b. Between edges of pairs of doors: 1/8-inch plus or minus 1/16-inch.
c. Between bottom of door and top of threshold: Maximum 3/8-inch.
d. Between bottom of door and top of finish floor (no threshold): Maximum 3/4-inch.

2. Fire-rated doors: Install doors with clearances as required by UL listing and complying with NFPA 80.
3. Smoke-control doors: Install doors according to NFPA 105.

F. Glazing:

1. Comply with installation requirements in Section 08 80 00 and with standard steel door and frame manufacturer's instructions.
2. Secure stops with countersunk flat- or oval-head machine screws spaced equally and symmetrically not more than 8 inches o.c., and not more than 2 inches from each corner.

3.4 TOUCHUP

A. Clean damaged primer, sand smooth, re-clean and spot-prime with paint compatible with the primer and the scheduled finish coats.
B. Before application of primer, touchup galvanized surfaces with zinc-rich coating where zinc coating is removed or damaged.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Five-ply flush wood doors for opaque finish.
2. Solid-core flush wood doors with plastic-laminate-faces (PLAM-3).
3. Louvers and vision panel frames in wood doors.

B. Work installed but furnished in other Sections:

1. Section 08 71 00 for finish hardware.
2. Section 08 80 00 for glazing.

C. Related requirements:

1. Section 09 90 00 for finish painting wood doors schedule to receive an opaque finish.

1.2 SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.

B. Shop Drawings:

1. Door schedule indicating opening identifying number, door type, grade, size, thickness, swing, label requirements, and undercuts.
2. Door elevations indicating hand of each door, and type of construction
3. Prefitting and premachining requirements, including dimensions and locations of mortises and holes for hardware.
4. Rating for fire-rated doors.
5. Use same reference numbers for openings and details as Contract Drawings.

C. Samples:

1. Frames for light openings, 6 inches long, for each material, type, and finish required.
2. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.

D. Data: Manufacturer Product Data for the finish system.
E. Certificate: Manufacturer’s certificate showing door compliance with these Specifications and the Woodwork Institute (WI).
F. Warranty: Warranty form from the door manufacturer.

1.3 QUALITY ASSURANCE

A. Uniformity: the same manufacturer shall make all flush wood doors for the Project.

1.4 HANDLING

A. Procedure: In accordance with WI Bulletin No. 416-R and Recommended Handling and Finishing Instructions for Wood Fire Doors.
Marking: Mark each door on top and bottom rail with opening number used on Shop Drawings.
B. Delivery:

1. Deliver doors independently factory-wrapped in polyethylene bags, unitized and palletized. Shrink-wrap each pallet and provide corner guards for protection.
2. Mark each door with architectural opening number in distribution and installation.
3. Do not deliver doors to the Project until proper storage space is available.

C. Storage:

1. Store doors in an assigned space having controlled temperature and humidity as recommended by WI.
2. Store doors flat on factory pallets.
3. Protect doors from construction activity and store away from direct sunlight.

D. Handling:

1. Handle doors with clean hands, except that doors to receive a transparent finish shall be handled with clean white gloves.
2. Do not drag doors across one another.
3. When provided, maintain factory packaging or other means of protection of doors until Substantial Completion.

1.5 JOB CONDITIONS

A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period.
B. Comply with referenced WI quality standard including Technical Bulletin 419 for moisture content and relative humidity.

1.6 WARRANTY

A. Special warranty:

1. Furnish to the Owner the door manufacturer written warranty against doors delaminating, telegraphing core through face veneer and against non-conformance with tolerance limitations of referenced quality standards for life of the installation 5 years after installation.
2. Include reinstallation that may be required due to repair or replacement of defective doors, during the warranty period, when defect was not apparent prior to hanging.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. One of the following, or equal:

1. Masonite Architectural.
2. Haley Brothers, Inc.
3. VT Industries.
4. Oregon Doors.
5. Oshkosh Door Company.
6. Or equal.

2.2 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. See PLAM-3 on sheet A601 -Interior Finish Materials sheet.
B. North American Architectural Woodwork Standards Grade: Premium.

1. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
2. Colors, Patterns, and Finishes: As indicated.
3. Exposed Vertical Edges: Plastic laminate that matches faces, applied before faces or impact-resistant polymer edging, applied after faces.

4. Core for Non-Fire-Rated Doors:

   a. ANSI A208.1, Grade LD-1 particleboard.
   b. Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
   c. Screw Withdrawal, Door Face: 475 lbf.
   d. Screw Withdrawal, Vertical Door Edge: 475 lbf.
   e. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

5. Construction: Five plies, hot-pressed or cold-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.3 FACTORY-MACHINING/FINISHING

A. Doors shall be 5-ply and comply with WI / WDMA PC5 construction. Doors shall be manufactured by the hot press method, bonding faes, crossbands and core together in a single operation with Type I glue. Doors manufactured by cold-pressing 2 or 3-ply pre-manufactured door skins to multiple cores in the same press will not be accepted.
B. Factory-machine doors by manufacturer or qualified distributor for cutouts, hinges, louvers, vision panels, locks and all hardware requiring routing or mortising.

1. When machining labeled doors comply with UL 10C and use caution to avoid voiding the manufacturer warranty.
2. Refer to Article 3.2 below for door clearances.

C. Prepare doors to receive finish hardware as follows:

1. Pilot drill screw and bolt holes.
2. Rout-out hinge locations.
3. Bore accurately for locks and latches.
4. Locate hardware where indicated on the Drawings as specified for hollow metal doors and frames in Section 08 11 13.

D. Factory-finish all faces and edges of doors to receive an opaque finish. Use painting system equivalent to WI North America Architectural Woodwork Standards section 5, Custom Grade System 2 “Water Reducible Acrylic Lacquer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine frames, adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLING FINISH HARDWARE/HANGING DOORS

A. Install finish hardware in compliance with its manufacturer's instructions and the requirements of Section 08 71 00. Fit accurately to doors.
B. Condition doors to average prevailing humidity in installation area prior to hanging.
C. Factory-fit doors to suit frame opening sizes indicated, with uniform clearances and bevels. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for labeled doors.

1. Trim non-fire rated doors by cutting equally at both edges
2. Trim door height by cutting bottom edge, maximum 3/4-inch; trim fire rated doors at bottom edges only, in accordance with fire rating requirements

D. Hang doors to operate freely for their entire travel, but not loosely, without sticking or hinge binding, with all hardware adjusted and functioning properly.

3.3 REPLACING DAMAGED DOORS

A. Replace doors showing chips, scratches, unbonded face veneers, glue stains, excessive warp or other damage that cannot be satisfactorily repaired, as determined by the Architect, with acceptable doors.

END OF SECTION

SECTION 08 31 16 - ACCESS DOORS & PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access panels not provided by other trades but required for access to concealed equipment and assemblies.
B. Work installed but not supplied under this Section: Access panels furnished by other trades.
C. Related requirements:

1. Division 09 for finish painting access panels.
2. Other Divisions for furnishing access panels to be installed under this Section.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Field verification: Verify actual locations of supports by field measurements and indicate measurements on Shop Drawings. Coordinate tolerances of other trades that may affect the work of this Section prior to start of Shop Drawings.
B. Pre-installation meeting:

1. Prior to start of work, arrange for Project site meeting of all parties associated with work of this Section, trades whose work affect the work of this Section, and trades whose work will be affected by the work of this Section.
2. Meeting shall be attended by the Contractor, firm installing the access doors (if more than one firm, than each one shall attend), trade responsible for substrates and supports to which access doors are installed, and access door manufacturer representatives.
3. Resolve conflicts and issue minutes of the meeting, in PDF format, to all present and the Architect within 48 hours of the meeting.

C. Sequencing:

1. Coordinate installation and cooperate with mechanical and electrical trades.
2. Coordinate stud layout and other support locations to provide a firm support for the panel frame.

1.3 SUBMITTALS

A. Data: The following manufacturer Product Data.

1. For each type of door and frame indicated.
2. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings for access doors and frames.
3. Supplement with Shop Drawings as follows:

    a. Dimensioned plan and elevation of each access panels in areas accessible to the public.
    b. Show special installation conditions.

B. Shop Drawings:

1. Show fabrication and installation details of customized doors and frames.
2. Include plans, elevations, sections, details, and attachments to other Work. Superimpose plan location on piping layout Shop Drawings.
3. The Architect reserves the right to ask for the relocation of up to 10 percent of the access panels and the utilities served, within a radius of 10 feet, at no cost to the Owner.

C. Coordination Drawings: Reflected ceiling plans drawn to scale, coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following.

1. Method of attaching door frames to surrounding construction.
2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.
3. Unless otherwise accepted by the Architect, no access panels will be allowed in hard ceilings (plaster and gypsum board) in public, and semi-public areas.

D. Samples: Samples for each door face material, at least 3 by 5 inches, in specified finish.
E. Schedule: Complete schedule of access panels, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.
F. Closeout: Keys properly tagged.

1.4 QUALITY ASSURANCE

A. All access panels for the Project shall be made by the same manufacturer.
B. In fire-resistive construction, provide fire-resistive assemblies bearing the label of a testing agency acceptable to the Building Department for the fire resistance indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Karp Associates, Inc. www.karpinc.com.
B. Acceptable manufacturer's:

1. Acudor Products Inc: www.acudor.com.
2. Elmdor/Stoneman Manufacturing Company; www.elmdorstoneman.com
3. JL Industries, www.jlindustries.comNon-fire-rated gypsum board walls and ceilings:
4. Or equal

2.2 ACCESS PANELS

A. General: Provide trimless, prime-coated units, except where stainless steel is specified, equipped with flush, key-operated cam lock.
B. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
C. Door and Frame Units: Formed Steel.

1. Frames and Flanges: 0.058-inch steel.
2. Door panels: 0.070-inch single thickness steel sheet.
3. Size: Size as called out on drawings or if not called out, then size to allow access to equipment in wall/ceiling cavities but not less that 12x12 inches in walls and 20 x 20 inch in ceilings.
4. Hardware:

    a. Hinge, Fire-Rated-Units: 175-degree steel hinges with non-removable pin.
    b. Hinge: 175-degree stainless steel piano hinge with removable pin.
    c. Lock: Cylinder lock with latch, two keys for each unit.

5. Prime coat with alkyd primer typical.
6. Finish: No. 4 stainless steel finish in toilet rooms and at exterior installations.

D. Non-Fire Rated Door and Frame Units in Walls.

1. In Gypsum Board on Steel Studs:

a. Exposed metal panels: Model KDW manufactured by Karp Associates when greater than 15 inches in either direction.
b. Gypsum Board inserts: Model RDW manufactured by Karp Associates when greater than 15 inches in either direction.

E. Acoustical Rated Access Panels:

1. Model KRP-STC (STC 64) Access Door by Karp Associates or equal by other approved manufacturer. These are to be used in Room's 921, 926, 939 and 938 and as indicated on drawings.

2.3 ACCESS PANELS

A. General: Provide trimless, prime-coated units, except where stainless steel is specified, equipped with flush, key-operated cam lock.
B. Models:

1. In gypsum board and plaster surfaces, except as specified below for toilet room walls and fire-rated access panels: Baucoplus-II series.

a. Material: Extruded aluminum alloy 6063-T6 frames and supports complete with 5/8-inch moisture and mold resistant gypsum board inlay and galvanized internal steel corner reinforcing. Zinc-plated hardened steel screws, free pivot hinge, safety cable with carabineer hook, vinyl screw caps, and EPDM rubber gaskets. Door: Fabricate using 2.8 mm thick extruded aluminum alloy 6063-T6 frame, screwed in place gypsum board inlay complete with galvanized internal steel corner reinforcing. Exposed top edge of frames shall have a concave meniscus rise to 0.5mm thick to accept finishing compound allowing a near invisible flush frame finish.
b. Frame: Recessed aluminum frame shall provide an edge similar to drywall bead against which the ceiling or wall surface shall be finished allowing a near invisible flush frame finish. Fabricate using 2.8mm thick extruded aluminum alloy 6063-T6 frame, complete with galvanized internal steel corner reinforcing. Frame opening complete with perimeter EPDM gasket maintaining the STC of gypsum board assembly.
c. Hinge Detail: Concealed, galvanized steel free pivot hinge shall allow all doors to open 120 degrees. All access panel doors shall be fully removable and complete with a safety cable to secure doors to panel frames with a safety cable, test rated for 135 lb. nylon coated, with crimp connections and spring snap aluminum carabiner.
d. Hinge Location: Baucoplus-II panels for ceiling installation - hinged on the longest side. When Baucoplus-II panels are used in a wall installation, the hinges must be located on the floor side.
e. Latching/Locking devices: Key operated cylinder lock, (2) keys per lock, keyed alike.
f. Finish: Door shall receive the same finish and paint as the surrounding surfaces.

2. Toilet rooms walls: Karp TypeSM.

a. Material: Stainless steel, 16-gage (0.053 inch) frame and 14-gage (0.067 inch) door.
b. Trim: 22-gage (0.0299 inch) stainless steel drywall bead.

3. Size: Unless otherwise indicated on the Drawings, provide minimum size to be 12-inch square opening for hand access; minimum 18-inch square for valve and actuator access; and 24-inch square for equipment access.

4. Where door cannot swing open, provide lift off type with safety wire or chain; Similar to Karp Type DSC-212.
5. In elevator shaft(s), provide self-closing, self-locking access door operable from the inside without a key.
6. Acoustical rated access panels:

    a. Frame shall be 16-gauge steel.
    b. Door shall be 20-gauge steel.
    c. Trim shall be 1-inch wide, one-piece construction.
    d. Gasketing between door and frame 3/8-inch wide by 1/8-inch-thick closed cell neoprene gasketing.
    e. Acoustical insulation shall be 2 3/8-inch thick.
    f. Hinge shall be continuous piano hinge.
    g. Latches shall be Lift & Turn Compression Latch finished in chrome with cup sealing gasket finished in chrome, keyed.
    h. Finish shall be prime coat of rust inhibitive electrostatic powder, baked white enamel. Stainless steel shall have No. 4 finish.
    i. Independently tested in accordance with ASTM: E1332, ASTM: E90, and ASTM: E413, and rated of STC 64 when installed according to manufacturer’s instruction.

2.4 MATERIALS

A. General:

1. Provide sheet metal selected for its surface flatness, smoothness and absence of surface blemishes where exposed to view.
2. Do not use materials where exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discoloration or other imperfections.

B. Galvanized steel sheet: ASTM A 653 CQ (commercial quality), or ASTM A 653 LQ (lock-forming quality), coating designation G90, mill-phosphatized, stretcher-leveled.

C. Steel sheet: Commercial quality cold-rolled carbon steel sheet, stretcher-leveled, complying with the following requirements at the fabricator's option.

1. Electrolytic zinc-coated steel sheet: ASTM A 591, with Class C zinc coating; chemically treated in mill with phosphate solution and light chromate rinse.
2. Cold-rolled steel sheet: ASTM A 1008.

D. Stainless steel sheet: ASTM A 167, Type 302 or 304, stretcher leveled.

E. Hardware:

1. Hinges for non-Bauco units: Concealed spring hinges or concealed continuous piano hinge set to open 175-degree. For fire-resistive units, provide self-closing mechanism.
2. Locking device: Flush, screwdriver-operated cam lock of number required to hold door in flush, smooth plane when closed.

    a. In public areas, provide keyed-alike cylinder lock on all access panels. Furnish 2 keys per lock.
    b. For recessed panel, provide access sleeves for each locking device. Provide plastic grommets installed in holes cut through finish.
    c. For locks on panels 24 inches in any dimension, provide interior latch mechanism to allow door to be opened from the inside without a key.

2.5 FABRICATION

A. Fabricate to profiles indicated without exposed cut edges.
B. Produce flat, flush surfaces without cracking and grain separation at bends.
C. Continuously weld exposed joints and seams; grind, fill, and dress welds to produce smooth flush exposed surfaces in which welds are invisible after final finishing is completed.
D. Provide exterior access panels with weatherproof extruded door gasket.
E. Finish:

1. When installed in ceramic tile surfaces, provide stainless steel panels finished with a NAAMM No. 4 (brushed) finish.
2. When installed in an exterior wall or soffit, fabricate assemblies from commercial quality carbon steel sheets complying with ASTM A 653 CQ, hot-dip galvanized to comply with ASTM A 924, G90, or hot-dip galvanize after fabrication to provide an equivalent zinc coating weight.
3. When installed in gypsum board or plaster walls, paint to match the adjacent walls.
4. Elsewhere provide access panels with a baked-on rust-inhibitive primer.

F. Identification: Mark inside surface of access doors with colored dot in accordance with the following color code.

1. Domestic Cold Water: Yellow.
2. Domestic Hot Water and Return: Yellow.
3. Fire Protection: Red.
4. Waste and Vent: Green.
5. Interior Rainwater Leaders: Green.
6. Natural Gas: Yellow.
7. Condensate: Green.
8. Reclaimed Water: Purple.
9. Gray Water: Green.
10. Treated Gray Water: Yellow and Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are properly framed, within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
C. Correct detrimental conditions proceeding with installation.

3.2 INSTALLATION

A. Install in accordance with the manufacturer’s recommendations.
B. Install plumb, level, and square with adjacent construction.
C. Attach assemblies securely to supports.
D. When installed in ceramic tile surfaces, coordinate panel location with the tilework so that the panel will align and fit within the tile module with no tile cutting, or a minimum of cutting.

3.3 FIELD QUALITY CONTROL

A. Adjust hardware for proper function so panels operate freely, but not loosely, without sticking or hinge binding.

END OF SECTION

SECTION 08 34 73 - SOUND-CONTROL DOOR AND WINDOW ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Sound control metal doors and door frames.
2. Sound Retardant Metal Fixed Window Systems.
3. Seals, inserts, clips, brackets and other miscellaneous items required for a complete installation.

B. Work installed but furnished in other Sections: Finish hardware (other than specified herein) specified to be furnished in Section 08 71 00.

C. Related requirements:

1. Division 04 for grouting metal frames installed in CMU openings.
2. Division 08 for non-acoustical hollow metal doors and frames and glazing.
3. Division 09 for finish painting this work.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data, specifications and recommended installation procedures.

B. Shop Drawings: Show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

C. Certification:

1. That the assemblies utilized have been tested in compliance with ASTM E 90 that they meet the STC losses scheduled below determined in compliance with ASTM E 413 is not less than 49.
2. Show laboratory name, test report number, and date of test.
3. Substitution of test reports not in compliance with ASTM E 90 and E 413 will not be acceptable.
4. For fire-resistive doors, certify that construction has been tested in compliance with UL procedures for labeled fire doors and frames, and meets the requirements of NFPA 80.

1.3 QUALITY ASSURANCE

A. Fire resistance: Provide fire-resistive assemblies bearing the label of a testing agency acceptable to the Building Department for the fire resistance indicated.

B. Uniformity: Provide all acoustical doors and frames made by one manufacturer.

C. The acoustical door assemblies shall meet or exceed the scheduled STC value, and in addition shall meet or exceed the following sound transmission loss values.

1.4 HANDLING

A. Delivery:

1. Inspect doors, frames, and accessories delivered to the site for damage. Unload and store, as specified, with a minimum of handling.

2. During delivery, strap doorframes together in pairs with the head of one frame inverted for bracing, or provide temporary steel spreaders securely fastened to the bottom of each frame.
3. Replace doors and frames damaged before installation. Do not install damaged doors and frames.

B. Storage:

1. Store doors and frames carefully on platforms under cover. Provide a 1/4-inch space between stacked doors.
2. The storage spaces shall be dry and accessible, adequately ventilated and free from dust or water, and shall permit easy access for inspection and handling.
3. Do not use non-vented plastic or canvas shelters that create a humidity chamber.
4. If the fiberboard wrapper on the door becomes wet, remove it immediately.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design requirements: Acoustical door assemblies to include doors, frames, and door hardware to include gasketing systems, retainers and retainer covers, automatic or fixed door bottoms, cam-lift hinges, thresholds, and sills, required to achieve specified performance requirements.
B. Sound Retardant Metal Swinging Door System STC ratings shall be the results of testing in accordance as an operable system in accordance with ASTM E90 and ASTM E413.
C. Components: Assemblies to be complete with metal frame, doors, sealing system (based on model specified), and Cam-Lift hinges (when required for model specified). Vision lights shall have metal loose stops (type based on model specified), glass and glazing shipped loose to be field installed.

2.2 MANUFACTURERS

A. Door Type B (from Door Types): Model 460460 Single Swinging Metal Door with Dual Glazed Vision Lite by Overly Manufacturing Co., basis of design.

1. STC Rating: 40 minimum.

B. Door Type D (from Door Types): Model 439572 Acoustical Metal Door by Overly Manufacturing Co., basis of design.

1. STC Rating: 40 minimum

C. Door Type F (from Door Types): Model 5192288 Single Swinging Metal Door with 15-inches by 20-inches Dual Glazed Vision Lite by Overly Manufacturing Co., basis of design.

1. STC Rating: 50 minimum.

D. Fixed acoustical rated windows 120, 129 and 131 (from window schedule): Model 549226 Dual Glazed Fixed Windows by Overly Manufacturing Co., basis of design.

1. STC Rating: 50 minimum.

E. Other acceptable manufacturers, meeting the requirements of these Specifications, include the following:

1. Krieger Steel Products Co.

2. Industrial Acoustics Co.
3. Or equal.

2.3 MATERIALS

A. Steel sheets and strip: As recommended by SDI 100.
B. Inserts, bolts and fasteners: Manufacturer standard units.
C. Door core: Manufacturer standard.
D. Shop primer: Manufacturer standard rust-inhibitive shop paint, compatible with finish paint specified in Section 09 90 00.
E. Hardware:

1. Seals: H seals at jambs and head. Adjustable H seal in door bottom.
2. Hinges: Model MCL-500, pair for non-labeled assemblies; pair and one-half for fire-rated assemblies.
3. Door closer: Norton 7500, or equal approved by the Architect.

2.4 FABRICATION

A. Fabricate this work to the profiles and dimensions indicated by roll-forming, brake-forming and welding to produce metal doors and frames with straight and square edges.

1. Doors: As based on test results to achieve STC ratings, minimum 16-gage sheet steel face sheets.
2. Frames: Minimum 14-gage sheet steel.

B. Fit and fabricate this work with surfaces free from warp, wave, buckle, oil canning or other defects.
C. Welding shall conform to AWS standards. Grind exposed welds flush and smooth with parent metal.
D. Preparation for finish hardware:

1. Reinforce the doors and frames for finish hardware in compliance with SDI 100, Table IV, and locate finish hardware in compliance with Table V of this publication.
2. Cut, drill and tap the doors and frames to receive finish hardware in compliance with the hardware manufacturer instructions and templates. Drill and tap doors in the field to receive surface-applied hardware. Provide reinforcement for closers on all doors and frames.

E. Cam Lift Hinges: When required to achieve STC, manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.
F. Hardware Reinforcements: Factory mortise, reinforce, drill and tap and doors and frames for all mortise hardware as required by hardware manufacturer's template. Provide necessary reinforcement plates as required for surface mounted hardware; all drilling and tapping to be done in field by installer. Provide dust cover boxes on all frame mortises.
G. Anchors: Provide suitable anchors to properly install frames in partition types shown on Drawings.

2.5 FINISHING:

A. After assembly, clean, treat, and paint exposed surfaces of steel door and frames.
B. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
C. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

D. Finish painting is specified in Section 09 96 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Level subfloor and thresholds so that they contact a straightedge for the length of the threshold.
B. Walk the site with the manufacturer's technical representative and review installation procedures and proper installation and adjustment of the assemblies or secure services of manufacturer's factory trained and authorized installer to perform installation of assemblies.
C. Examine adjacent construction and supports.
D. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
E. Correct other conditions detrimental to the proper or timely completion of this work before proceeding with installation.

3.2 INSTALLING FRAMES

A. Install frames plumb, square and straight, in compliance with the Drawings, these Specifications, the approved Shop Drawings and UL tested procedures for fire-rated openings.

1. Provide a minimum of 2 anchors for head of double door frames.
2. Provide a minimum of 3 anchors per jamb for frame with doors under 81 inches high; provide one additional anchor for doors in frame over 81 inches.
3. Attach jamb anchors securely to studs.

B. Brace the frames to prevent their displacement during erection of adjacent walls, and coordinate the installation of built-in anchors with related trades.
C. Provide UL approved adjustable floor clips for all frames and anchor them securely to concrete slabs with powder-driven pins or bolts in expansion shields.

3.3 INSTALLING FINISH HARDWARE/HANGING DOORS

A. Install finish hardware in compliance with the hardware manufacturer templates and printed instructions.
B. Adjust operable parts for correct function so the doors operate freely, without sticking or binding, but so that seals are in contact with frame and floors for their entire length when the door is closed.
C. Install doors in their frames and adjust them to meet the STC specified when closed. Do not install doors that are warped, bowed, dented or otherwise damaged.

3.4 FIELD QUALITY CONTROL

A. Secure the services of a qualified Independent Testing agency to test door and frame installations selected by Owner/Architect in accordance with ASTM E336. Installed product shall perform no less than five Field Sound Transmission Class (FSTC) rating points below the specified laboratory STC rating. Any installations which fail to meet these criteria shall be examined, re-worked and re-tested until compliance is obtained.
B. Clean damaged primer, sand smooth, re-clean and spot prime with a paint compatible with the primer and the scheduled finish coats.

END OF SECTION

SECTION 08 35 13 - ALUMINUM-FRAMED STACKING GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Thermally broken stacking glass doors complete with hardware.
2. Glass and glazing for the work of this Section.

B. Related requirements:

1. Section 08 32 13 for aluminum-framed sliding glass doors.
2. Section 08 43 13 for aluminum storefronts and doors.
3. Section 08 71 00 for door hardware.
4. Section 08 80 00 for glazing.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data for doors, including the following.

1. Construction details and fabrication methods.
2. Profiles and dimensions of individual components.
3. Data on hardware, accessories, and finishes.

B. Shop Drawings: Large scale dimensioned Drawings: Include information not fully detailed in manufacturer's standard Product Data and the following.

1. Layout and installation details, including anchors.
2. Elevations of units at 3/4-inch scale.
3. Full-size section details of typical composite members, including reinforcement.
4. Hardware, including operators.
5. Glazing details.
6. Accessories.

C. Samples: 12-inch long sections of door frame with specified finish. Where finish involves normal color variations, include sample sets showing the full range of variations expected.

D. Certification:

1. Certification by a recognized independent testing laboratory or agency showing that each type, grade, and size of unit complies with performance requirements indicated in Part 2.
2. Where reports are not available, engage a recognized independent testing laboratory or agency to perform tests specified. Provide certified test results showing that unit complies with performance requirements indicated.

E. Closeout: Recommendations for maintenance and cleaning of surfaces.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain entrances, storefronts, sliding glass doors, window systems, and finish through one source from a single manufacturer.

B. Installer qualifications: Firm who has completed installation of sliding glass doors similar in design and extent to those required for the Project and whose work has resulted in construction with a record of successful in-service performance.

C. Standards: Requirements for doors, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA 101 and applicable general recommendations published by AAMA.
D. Single source responsibility: Provide all sliding aluminum doors from one source and produced by a single manufacturer.

1.4 HANDLING

A. Transport, store and handle assemblies to prevent damage. Store off the floor in a protected location.

1.5 WARRANTY

A. System, folding system hardware, and weatherstripping shall be warranted against failure and/or deterioration of metals due to manufacturing process for a period of 10 years.
B. Locking Hardware shall be warranted for a period of 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER/TYPE

A. Basis of design: 1000 Oasis Series (thermal) Bi-Folding aluminum Door, 2-1/4-inch-thick panel section, by Arcadia Architectural Products, Inc., 5190 S. Santa Fe Ave, Vernon, CA 9058. 323-908-5467, fax 323-908- 5547.

1. Vertical stile: 3-1/2 inches.
2. Top rail: 3-1/2 inches.
3. Bottom rail: 3-1/2 inches.
4. Glazing Insert: Snap-in type for 1-inch infill.

B. Euro-ST3 Stacking Framed Doors by Euro-Wall www.euro-wall.com. Email: engineering@euro-wall.com.
C. Or equal.

2.2 PERFORMANCE REQUIREMENTS

A. System performance of 39-inches x 120-inches panel. Each assembly shall be tested by a recognized testing laboratory or agency in accordance with specified test methods.

1. Air Infiltration: 1.6 PSF (25 MPH) ASTM E 283.
2. (Weather Resistant Sill Only/Non-ADA).
3. Water Infiltration: 5.4 PSF ASTM E 547 (Weather Resistant Sill Only/Non-ADA with Outswing Application).
4. Uniform Load Deflection: + -30.0 PSF ASTM E 330.
5. Uniform Load Overload: + -45.0 PSF ASTM E 330.
6. Forced Entry Top & Bottom of Stile 3" above lock AAMA 1304-02.
7. Overall DP Rating: DP 30.

B. Design requirements:

1. Comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA 101 SGD-R15.
2. Comply with Code for design wind velocity at the Project site as indicated.

2.3 MATERIALS

A. Door members: Extruded 6063-T6 aluminum alloy (ASTM B221 - Alloy G.S. 10aT5).
B. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A-164 shall be aluminum or steel, providing the steel is properly isolated from aluminum.
C. Glazing Gasket (compression-type design).

2.4 HARDWARE

A. Hardware for 10000 Series Bi-Folding Aluminum Door shall be furnished and installed by the manufacturer and shall include the following standard hardware
B. Hardware system carrying capacity to be 220 lbs. per panel.
C. Weatherstripping: Q-Lon seals at the top inner and outer edge of door panels or on frame for sealing between panels and between panel/frame. Exterior bottom door panel blade sweep.
D. Sill track: Aluminum (Clear or Bronze Anodize) standard weathered engineered weeping thermally broken threshold, or non-weathered ADA Ramp Sill, and ADA Flush Guide Sill options
E. Stainless Steel Roller Guide Spindle
F. Guide Channel: aluminum
G. Top Guide Carrier/Hanger
H. Two Point Locking Hardware on folding panels, pull handle(s)
I. Four Point Locking Hardware with Lever Lock on Main Entry Panel
J. Magnetic Door Stop for entry swing panel and for stacking of folding panels.

2.5 FABRICATION

A. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts. Exposed screws not permitted.
B. Swing/stacking direction: Outswing (or inswing) opening unit.
C. Define as window systems for net frame heights 72" or less.
D. Each frame corner joint shall be secured with two stainless steel screws.
E. Sealants and back-up rods:

1. Within assemblies: Manufacturer's standard non-drying, non-skinning sealant complying with AAMA 809.2.
2. Between assemblies and adjacent materials: As specified in Section 07 92 00.
3. Glazing sealants: Refer to Section 08 80 00.

2.6 FINISH:

A. Sight-exposed aluminum surfaces: Finish as specified for storefronts in Section 08 43 13.
B. Steel brackets: Prime with rust-inhibitive primer.

2.7 GLAZING:

A. Factory-glaze doors. Comply with glass manufacturer's recommendations and requirements of Section 08 80 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.

C. Correct detrimental conditions before proceeding with installation.
D. The maximum deflection of the header with the live load shall not exceed the lesser of L/720 of the span and 1/4-inch. Structural support for lateral loads (both windload and when the panels are stacked open) must be provided.

3.2 INSTALLATION

A. Do not install components that are bowed, dented, abraded, broken or otherwise defective.
B. Install in accordance with approved shop drawings and manufacturers installation instructions.
C. Install doors level, plumb, square and with tight fitting joints. Attach to supporting construction with non-staining and non-corrosive shims, anchors, fasteners and spacers.
D. Installer to provide adequate anchorage devices and to securely fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work. Head section of frame must be installed with a 1/8-inch upward crown at the center of the opening.
E. Ensure doors are adjusted at the time of installation for proper operation.
F. Install sills in a full bed of sealant.
G. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with the requirements specified under "Dissimilar Materials" in the Appendix to AAMA 101.
H. Provide all accessories such as fasteners, sealants and concealed anchorage needed for a complete, weatherproof installation.

3.3 ADJUSTING

A. Adjust operating panels and hardware to provide a tight fit at contact points and weatherstripping for smooth operation and weathertight closure.
B. Weatherstrips shall not bind or prevent sash or ventilator from closing easily and tight with weathertight contact between metal.
C. Lubricate hardware and moving parts.

3.4 FIELD QUALITY CONTROL & CLEANING

A. Clean aluminum surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging finish.
B. Remove protective coating and excess glazing and sealants, dirt, and other substances.
C. Clean glass immediately after installing doors. Comply with manufacturer's recommendations for final cleaning and maintenance. Remove nonpermanent labels from glass surfaces.
D. Remove and replace glass broken, chipped, cracked, abraded, or damaged during the construction period.

END OF SECTION

SECTION 08 36 19 - BI-FOLD HYDRAULIC VERTICAL LIFT DOORS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Furnish Bi-Fold Electric (BFe) System complete from one manufacturer.
B. Provide all labor, materials, tools and equipment to furnish the Bi-Fold Electric System complete as herein specified.
C. Related requirements:

1. Division 26 for power and disconnect switch for door motors, and conduits between motors and controls.
2. Division 28 for security system.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data, including specification, roughing-in diagrams, and installation instructions.
B. Shop Drawings:

1. For special components and installation conditions not fully dimensioned or detailed on manufacturer's data sheets.
2. Show attachment details to support and interface with adjacent construction.

C. Wiring diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by other trades.
D. Samples: 12-inch long Samples of slat.
E. Installer's certificates: Signed by manufacturer certifying that installer complies with specified requirements.
F. Closeout submittals: Operating and maintenance instructions for the door.

1.3 QUALITY ASSURANCE

A. Provide each Bi-Fold Electric System as a complete unit by one manufacturer, including frames, panels, brackets, guides, hardware, operators and installation accessories to suit opening.
B. Installer qualifications: Manufacturer authorized representative trained and approved for both installation and maintenance of units required for this Project.
C. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, Article 100.
D. Preparation of the opening shall conform to current criteria set forth by the California Building Code.

1.4 HANDLING

A. Proper storage of the Bi-Fold Electric system before installation and continued protection during and after installation will be the responsibility of the general contractor.

1.5 WARRANTY

A. Frame/Panel, electric actuators and controls shall be guaranteed for one year against defects in material and workmanship from date of delivery.
B. Factory-supplied, manufacturers-standard glass retainer system and glass inserts shall be guaranteed for one year against defects in material and workmanship from date of delivery.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIRMENTS

A. Wind Loading: Manufacture each Bi-Fold Electric System to withstand 90 mph pressure. Higher pressure requirements may be considered on a project-by-project basis.
B. Operation-cycle requirements: Design door components and operator for a useful life of 10,000 cycles, at a minimum of 4 operations per day.

2.2 Acceptable Manufacturers

A. SST-II Hydraulic Bi-Fold System by Crown Doors, 135 McLeod Avenue, South Plato MN, T (320) 238-2616
B. Or equal.

2.3 DOOR PANELS

A. Product to be equal to Bi-Fold Electric (BFe) System as furnished by Crown Doors, LLC (Crown).

1. Construct panel/frame with structural steel tube (of ASTM-A500 grade minimum) framing to comply with applied wind code.
2. Frames shall be constructed of structural steel tubing and other structural steel shapes, and designed to the same loading requirements for live, dead and wind loads as the surrounding construction, with a maximum CTC from vertical and horizontal members of 60”.
3. Panel frame shall be designed so that no center “cane bolt” is required in the floor.
4. Panel frame shall be factory-welded at all joints and connections, with smooth welds not to exceed 1/4-inch thickness.
5. System shall include factory-installed, steel “Insidesash” (infill) glass retainer system (glazing stops) and glass inserts
6. Panel frame and glazing stops shall be factory powder-coated any manufacturers’ std. RAL color for finish and corrosion resistance.
7. System shall include full-perimeter, factory-installed neoprene seals/weather stripping.

B. Door shall be operated by linear actuators that are mechanically fastened to the panel frame.

1. Actuators will be designed to carry the required loads during operation, open position, and closed position.
2. Speed: Approx. 30-40 sec. fully closed to fully open position.

C. Power: Standard voltage is 120v, single phase, 10-amp.

1. Controls: Key switch controls for separate mounting, by others.
2. Control box to operate (2) linear actuators which open and close the door/window. Control box to be pre-wired, factory-tested and provided with supply cables for final hook-up.

3. Incoming electrical source to control box to be supplied by Division 26.
4. Each linear actuator shall have thermal overload protection for the motors.

D. Finishes: Entire system frame and panel shall be cleaned and factory powder-coated any manufacturer's std. RAL color for finish and corrosion resistance.
E. Accessories: Photo eyes or lead-edge sensor that stops (or stops and reverses) the downward movement of the door/window.

2.4 OPERATION

A. The Bi-Fold Electric System shall be extended/retracted in the opening using a key switch, operating linear actuators mounted to the door/ window frame.
B. Provide a photo eye sensor to stop operation if there is interference with the operation.

2.5 FASTENERS

A. Use type 316 stainless fasteners.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that opening is within allowable tolerances, plumb, level, clean, will provide solid anchoring surfaces.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Installation of the Bi-Fold Electric System shall be by a contractor familiar with this type of installation and be in strict accordance with the drawings and manufacturer's shop drawings, printed specifications, instructions and recommendations. All moving parts will be left in good operating condition.
B. Install doors and their operating equipment in compliance with the door manufacturer's instructions, plumb, in true alignment, free of springing, forcing, racking or distortion.
C. Permanent or temporary electric wiring shall be brought to the control box location before installation. After the Bi-Fold Electric System is installed, the general contractor assumes the responsibility of any damage to the system or system components during construction until the building is turned over to the owner.

3.3 FIELD QUALITY CONTROL/DEMONSTRATION

A. Touchup: Touchup damaged finish to match adjacent undamaged surfaces, when the results are satisfactory to the Architect, otherwise return the damaged component to the shop for refinishing.
B. Demonstration: Engage a factory-authorized service representative to perform startup services as follows:

1. Startup:

a. Test and adjust controls and safeties.
b. Replace damaged and malfunctioning controls and equipment.
c. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.

3.4 CLEANING

A. All surfaces shall be wiped clean and free of handprints, grease and oil.

3.5 TRAINING

A. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.
B. Operating keys and owner’s manual shall be provided to Owner's Representative.

END OF SECTION

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS AND ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Storefront framing.
2. Aluminum-framed glass doors.
3. Mullion covers, subframes, reinforcement and anchors, and sealants for the work of this Section.
4. Supplementary parts and components, such as inserts, clips, fasteners, anchors, bracing and other miscellaneous supports required for a complete, weatherproof installation.

B. Work installed but furnished in other Sections:

1. Section 08 71 00 for finish hardware on doors.
2. Section 08 80 00 for glazing.

C. Related work:

1. Section 08 32 13 for aluminum-framed sliding glass doors.
2. Section 08 35 13 for aluminum-framed stacking glass doors.
3. Section 08 71 00 for door hardware.
4. Section 08 80 00 for glazing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. See Section 01 40 00 for additional requirements.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop drawings:

1. Large scale dimensioned shop and erection drawings for the work of this Section showing the following:

a. Elevations.
b. Detail sections of typical composite members.
c. Hardware mounting heights.
d. Hardware schedule and indicate operating hardware types, quantities, and locations.
e. Expansion provisions.
f. Glazing details.

2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Show relative layout of adjacent beams, columns, and slabs, all correctly dimensioned.
5. Identify shop and field sealants by product name and locate on shop drawings.
6. Identify welds, both shop and field, by AWS welding symbols.

C. Samples:

1. Cutaway sample: Of each vertical-to-horizontal framing intersection of systems, made from minimum 6-inch lengths of full-size components and showing details of the following.

    a. Joinery.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Identify samples gage, alloy, color and finish.

2. Structural-sealant joints construction, with specified finish and color.
3. Glazing gaskets: 12-inch long samples.

D. Calculations: The following for the work of this Section.

1. Prepare calculations in compliance with current design rules of AA, AISC, AISI, and ACI. Include analysis for wind and dead load on framing members, anchors, and concrete inserts.
2. Show section property computations for framing members. Show vertical and horizontal loads on curbs and other supports. Existing test reports will be acceptable substitute for calculations. Calculations shall be signed and sealed by a California-licensed professional engineer.
3. Do not increase allowable stresses or decrease applied loads for design wind loads, or wind loads in combination with other loads, where not permitted by Code, or if resultant allowable stress after increase is greater than or equal to yield stress.

E. Qualification Data:

1. For Installer.
2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

F. Certification: Certified test results showing that entrance and storefront systems have been tested by a recognized testing laboratory or agency and comply with specified performance characteristics.

1.5 QUALITY ASSURANCE

A. Fabricator/installer’s qualifications: Single firm with a minimum of 5 years of successful experience fabricating and erecting work similar to that required for this Project.

B. Engineering responsibility:

1. Engineer, fabricate, assemble and erect the work of this Section to meet or exceed the specified design and performance criteria, and to provide watertight, structurally sound, self-draining assembly conforming to governing codes and regulations.
2. The assemblies shown on the Drawings and specified herein are intended to define design intent and minimum performance requirements. Do not change indicated profiles without the Architect's written consent.
3. Fasteners and connections are shown schematically. A California-licensed civil or structural engineer employed by the Contractor shall determine final types and sizes.
    a. In no case shall the fasteners or connections conflict with or require revision of the finish profiles of the assemblies specified herein or the supporting work.
    b. Connections to the structural frame shall not impose any eccentric loading, or induce twisting or warping.
    c. Connections to the structural frame shall be able to accommodate misalignment of the steel structure within limits allowed by the AISC tolerances.

C. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

D. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and acceptable to Owner and Architect.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 HANDLING

A. Procedure: "Care and Handling of Architectural Aluminum from Shop to Site" published by AAMA.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 5 years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Warrant the work of this Section against defective materials and workmanship for 2 years after Substantial Completion. Refer to Section 07 92 00 for sealant warranty.

D. Repair or replace, when repairs are acceptable to the College Representative, defective materials and workmanship during the warranty period at no cost to the College.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

B. Basis of Design: Arcadia Inc. These systems have been reviewed and approved by DSA.

1. AFG601T (2-inches x 6-inches)
2. AFG451T (2-inches x 4-1/2-inches).
3. Acceptable manufacturer: These may be acceptable, based on Architect's review and approval, for submittal to DSA. If one of these manufacturers are used and cannot reproduce DSA design and approval in a timely manner, then the Contractor shall be subject to a time and material back charge for any delays in the project. Architect approval is required prior to DSA submittal and DSA approval is required prior to installation.
   1. Kawneer Co., Inc.
   2. OldCastle BuildingEnvelope.
   3. Or equal.

C. Basis of design: Aluminum-framed doors, by Arcadia Inc.:

1. Type: Heavy Duty Wide Style WS512 HD.

D. Fixed storefront sections: Of the dimensions and profiles indicated.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 - Quality Requirements, to design aluminum-framed entrances and storefronts for any system other than the basis of design system which has been approved by DSA.

B. General: Provide aluminum entrance and storefront systems capable of withstanding loads, and thermal, seismic and structural movement indicated without failure, based on testing manufacturer standard units in assemblies similar to those indicated for this Project. Failure includes the following.

1. Air infiltration and water penetration exceeding specified limits for exterior assemblies.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

C. Glazing: Physically and thermally isolate glazing from framing members.

D. Glazing-to-glazing joints: Provide glazing-to-glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.

E. Wind loads

1. Provide assemblies in exterior walls, including anchorage, capable of withstanding wind-load design pressures prescribed by Code, but not less than 20 psf inward and outward.
2. Provide interior assemblies, including anchorage, capable of withstanding a lateral pressure of not less than 5 psf.
3. Limit deflection of framing members in a direction normal to wall plane to 1/175 of clear span or 3/4 inch, whichever is smaller.
4. Static-pressure test performance (exterior assemblies): Provide assemblies that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test pressure: 150 percent of inward and outward wind-load design pressures.
b. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

F. Seismic loads: Provide assemblies, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction.

G. Dead loads:

1. Provide glazing members that will not deflect an amount, which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
2. Provide a minimum 1/8 inch clearance between members and top of glazing or other fixed part immediately below.
3. Provide a minimum 1/16 inch clearance between members and doors.

H. Live loads: Provide assemblies, including anchorage, that accommodate the supporting structure deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

I. Air infiltration:

1. Provide exterior storefront systems with permanent resistance to air leakage of not more than 0.06 cfm/square foot of fixed wall area when tested according to ASTM E 283 at a static air pressure difference of 6.24 psf.
2. Provide exteriorsingle acting offset doors with air infiltration not exceeding 0.50 cfm/lineal foot of perimeter crack. A pair of 6-foot by 7-foot doors and frame shall not exceed 1 cfm/linear foot of perimeter crack.

J. Water penetration:

1. Provide exterior storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 8 psf.
2. Water leakage is defined as uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation.
3. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

K. Thermal movements:

1. Provide exterior assemblies, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
2. Temperature change (range): 120-degree F. ambient, 180-degree F. material surfaces.

L. Movements of the structural-support: Provide assemblies that accommodate structural movements including, but not limited to, sway and deflection.

M. Dimensional tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

N. Performance requirements for doors: Resistance to corner racking shall be tested by the "Dual Moment Load" test as follows.

1. Test section shall consist of a standard top door corner assembly. Side rail section shall be 24 inches long; top rail section shall be 12 inches long.
2. Anchor "top rail" positively to test bench so that corner protrudes 3 inches beyond the bench edge.
3. Anchor a lever arm positively to "side rail" at a point 19 inches from the inside edge of "top rail." Attach weight support pad at a point 19 inches from inner edge of "side rail".
4. Test section shall withstand a load of 170 lb. on the lever arm before reaching the point of a 1/18 inch gap at the stile/rail, joint or a 3-degree rotation in the stile. Further failure, defined as a rotation of the lever arm in excess of 45, shall not be reached before 270 lb.

2.3 STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Superior-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Heavy Duty Wide Style; 5-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."
B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

E. Cylinders and Panic Exit Devices: As specified in Section 08 71 00 "Door Hardware."
F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
G. Operating Trim: BHMA A156.6.
H. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.
I. Door Stops: As specified in Section 08 71 00 "Door Hardware."
J. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.

2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

K. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

L. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

M. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 - Glazing.

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by the manufacturer for strength and application of required finish, complying with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate.

B. Steel mullion reinforcement, if required by wind loading and other considerations: Proprietary bent steel plate or structural steel shape complying with the following.

1. Hot-rolled sections: ASTM A 36.
2. Structural tube framing: ASTM A 500, Grade B.

C. Fasteners: 300 Series (18-8) non-magnetic stainless steel for all screws, bolts, nuts, washers and rivets, except for the following applicable to Self-drilling and self-tapping screws.

1. Comply with SAE J78, except shanks and heads of fasteners shall comply with SAE i429, Grade 5 with 827 MPa (120 ksi) tensile strength and Rockwell C34 maximum hardness.
2. Where additional corrosion resistance is required, such as where fastener heads are exposed to aggressive environments, shanks and heads of fasteners shall be made of Series 300 (18-8) stainless steel complying with ASTM F 593, Condition CW (i.e. cold-worked), 689 to 1034 MPa (100 to 150 ksi) tensile strength, Rockwell 895 to C32 hardness.
3. Emboss fastener heads with manufacturer’s mark for inspection purpose and to indicate fasteners comply with Specifications.
4. Carbon steel fasteners shall have corrosion-resistant, hexavalent chrome-free coating with a zinc-rich base coat and an aluminum-pigmented organic topcoat. Fastener shall withstand 800 hours test, without forming red rust, when tested according to ASTM B 11 7.
5. Emboss 300 series stainless steel fasteners with the manufacturers mark for inspection purpose and to indicate fasteners comply with Specifications and applicable standards. Fasteners shall have a galvanically-compatible finish and coating, hexavalent chrome-free, zinc plate base and an aluminum-pigmented organic topcoat.

D. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125-inch thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.

1. Welding electrodes: As recommended by AWS for the type of metal to be welded and the conditions of use.

E. Brackets: Where feasible, provide high-strength aluminum brackets and reinforcements; otherwise provide non-magnetic stainless steel or steel complying with ASTM A 386.

F. Compression weatherstripping: Manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded silicone of the color selected by the City Engineer.

G. Sliding weatherstripping: Manufacturer's standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.
H. Glass and glazing materials: As indicated on the Drawings and specified in Section 08 80 00.
I. Sealants and backup rods:

1. Within assemblies: Manufacturer standard non-drying, non-skinning sealant complying with AAMA 809.2.
2. Between assemblies and adjacent materials: As specified in Section 07 92 00.
3. Glazing sealants: Refer to Section 08 80 00.

J. Paint:

1. Exposed aluminum finishes: See below.
2. Shop primer for ferrous metal: Manufacturer or fabricator standard, fast-curing, lead-free, universal rust-inhibitive alkyd primer complying with performance requirements of FS TT-P645.
3. Shop primer for concealed aluminum surfaces: Alkyd barium metaborate made by one of the manufacturers listed in Section 09900, or bituminous paint.
4. Galvanizing repair paint: SSPC Paint No. 20, Type II (Organic), by Tnemec, Porter International, Valspar Corp., Ameron Protective Coatings, or DuPont Co.
5. Bituminous paint: Cold-applied asphalt mastic complying with SSPC Paint 12, but containing no asbestos fibers.

2.8 FABRICATION

A. Furnish shop drawings, inserts and similar items to other trades, at appropriate times as required for proper sequence of construction.

1. Verify dimensions of the supporting structure and other elements that precede this work before fabrication of the required components.
2. Provide erection tolerances corresponding with specified tolerances for other work wherever field measurements cannot be obtained.

B. Maintain the visual design concept shown, including member sizes, profiles and alignment of components.
C. Fabricate and assemble components with proper and acceptable provision for noiseless thermal expansion and contraction, fabrication and erection tolerances, adjoining building component tolerances, and dynamic movements.
D. Fabricate and assemble components with minimum perimeter clearances and shim spacing but enable installation and dynamic movement of perimeter seals.
E. Removable members such as glass stops, fillers or closures shall be extruded, and securely engaged into adjacent components. Fabricate extrusions to eliminate edge projection, bowing, and misalignment at joints.
F. Design and construct expansion joints so that they will be, and remain, permanently watertight, and will accommodate weather and building dynamics.
G. For surfaces exposed to view employ only materials which are free from alloy defects, die marks, scratches, streaks and other surface blemishes.
H. When using aluminum sheets, use material light enough to permit workability but heavy enough to accurately retain the brake shape or contour without oil-canning when fastened to backing or blocking.
I. Complete the fabrication and assembly of the components in the shop to the greatest extent possible to minimize field cutting, splicing, fastening, sealing and finishing.

1. Maintain provisions for expansion and movement.
2. Disassemble only as necessary for shipment and erection.

3. Provide secure attachment and support at joints, with hairline, flush fit between contacting members.

J. Complete the cutting, fitting, forming, drilling and grinding of metal before cleaning and applying specified finish. Remove arrises from cut edges and ease edges and corners to a radius of approximately 1/64 inch minimum, 1/32 inch maximum.

K. Welding:

1. Comply with industry standards for assembly and fabrication using system and rods for exposed metals that will provide texture match with materials being joined.
2. Grind exposed welds smooth and flush with parent metal using clean grinding wheels of a type that will not result in stains or discoloration.

L. Hardware:

1. Cut, reinforce, drill and tap doors and frames at the factory to receive hardware.
2. Provide hardware reinforcement of stainless steel or hot-dip galvanized steel secured by welding or stainless-steel screws.

M. Door fabrication:

1. Make proper allowance for clearances at jambs, meeting stile of pairs, head and threshold thickness and clearance.
2. Equip meeting stiles on pairs of doors with an adjustable astragal.
3. Close the top of out-swinging doors with a plate or inverted channel.
4. Cut, reinforce, drill and tap doors and frames at the factory to receive hardware. Provide hardware reinforcement of stainless steel or hot-dip galvanized steel secured by welding or stainless-steel screws.

2.9 EXPOSED ALUMINUM FINISHES

A. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. (MT-1)

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: PPG Duranar UC51595XL Medium Gray. As indicated on Drawings.

2.10 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface, and that other conditions detrimental to the proper or timely completion of this work are corrected before proceeding with installation.

3.2 INSTALLATION

A. General:

1. Do not install defective components, including warped, bowed, dented, abraded and broken members, and glass with damaged edges.
2. Remove and replace members that have been damaged during installation or thereafter before final acceptance.
3. Do not cut, trim, or weld components during erection in a manner that would damage the finish, decrease their strength, or result in a visual imperfection or a failure in performance of the work.
4. Return components that require alteration to the shop for refabrication or replacement.
5. Install components level, plumb, true to line and with uniform tight joints and reveals. Attach to structure with non-staining and non-corrosive shims, anchors, fasteners and spacers.
6. Provide all accessories such as fastenings, sealants and concealed anchorage needed for a complete weatherproof installation.

B. Erection tolerances:

1. Provide adjustment within the assemblies to accommodate job variations.
2. Install the work of this Section within the following tolerances:

   a. Deviation from established vertical, horizontal, or designed position shall not exceed 1/8 inch in 12 feet of length of any member, or 1/4 inch in any total run in any line.
   b. Maximum offset from true alignment between 2 consecutive members placed end-to-end shall not exceed 1/16 inch.
   c. Maximum offset between glass framing members at corners of glazing pocket must not exceed 1/32 inch.

C. Assembly and anchorage:

1. Anchor components securely by bolting, welding or other permanent mechanical attachments system that will comply with specified requirements and permit movements that are intended or necessary.
2. Install slip-joint linings where required to ensure movement without damage of the components.
3. Provide tape separator between contact surfaces of dissimilar materials where there is a possibility of corrosive or electrolytic action.
4. Remove weld slag and apply primer over welds. Touchup shop applied paint damaged by welding or other causes.

D. Glazing:

1. Glaze assemblies as specified in Section 08800.
2. Carefully match joints of glazing beads. Drive screws securing such beads fully and tighten with heads firmly seated.

E. Hanging doors:

1. Install finish hardware on doors in compliance with its manufacturer's instructions.
2. Hang doors with minimum clearance to frame and threshold to meet the performance criteria specified.
3. Hang doors and adjust hardware so doors operate freely for their entire travel, without sticking or binding, and with minimum clearance to frame to comply with performance criteria specified.

3.3 SEALANTS

A. The requirements of Section 07 9200 apply to sealants used in this work. Seal all joints between the work of this Section and adjacent construction to be weathertight.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
      a. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust door hardware for smooth operation according to hardware manufacturers' instructions.
B. Adjust door closers so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Sound Control Hollow Metal Door Assemblies”.
4. Division 08 Section “Sound Control Wood Door Assemblies”.
5. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Proof of Compliance: (California located Projects): Provide a list of product(s) containing chemicals known to cause cancer or reproductive toxicity as defined by the Office of Environmental Health Hazard Assessment (OEHHA) under Proposition 65 (CA Code of Regulations, Title 27, Section 27001). The list includes the specific chemical(s), if the chemical will be exposed to consumers, the means of warning, and an illustration of the label.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. California Building Code: Provide hardware that complies with CBC Section 11B.

1. All openings as a part of an accessible route shall comply with CBC Section 11B-404.
2. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 4” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. CBC Section 11B-404.2.3.
3. Operable hardware on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.
4. Hardware (including panic hardware) shall not be provided with “nightlatch” function for any accessible doors or gates unless the following conditions are met:

    a. Such hardware has a ‘dogging’ feature and is dogged during the time the facility is open.
    b. All ‘dogging’ operation is performed only by employees as their job function (non-public use).

5. The force for pushing or pulling open a door shall be in accordance with CBC Section 11B-404.2.9.

    a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
    b. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
    c. The 5 pound (22.2 N) maximum force shall be validated for the size of the door used. The Building Materials Listing of the California State Fire Marshal shall indicate that the door hardware meets the 5 pound (22.2 N) force and shall also list the largest door that can be used.

6. Door closing speed shall comply with CBC Section 11B-404.2.8. Closers shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
7. Floor stops shall not be located in the path of travel and 4” maximum from walls.
8. Thresholds shall comply with CBC Section 11B-404.2.5.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution

Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

   a. Hager Companies (HA) - AB Series, 2 knuckle.
   b. McKinney (MK) - TA Series. 2 knuckle.
   c. No Substitution.

6. Manufacturers:

   a. Hager Companies (HA) - AB Series, 3 knuckle.
   b. Ives (IV) - 3CB Series, 3 knuckle.
   c. McKinney (MK) - TA Series, 3 knuckle.
   d. dormakaba Best (ST) - CB Series, 3 knuckle.
   e. No Substitution.

7. Manufacturers:

   a. Hager Companies (HA) - BB Series, 5 knuckle.
   b. Ives (IV) - 5BB Series, 5 knuckle.
   c. McKinney (MK) - TA/T4A Series, 5 knuckle.
   d. dormakaba Best (ST) - F/FBB Series, 5 knuckle.
   e. No Substitution.

B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

   a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
   b. Pemko (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. McKinney (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. Pemko (PE) - EL-CEPT Series.
   b. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

   a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
   b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

   a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
5. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Hiawatha, Inc. (HI).
    c. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide temporary keyed construction cores.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

P. Electronic Key Management System: Provide an electronic key control system with Stand-alone Plug and Play features including advanced RFID technology. Touchscreen interface with PIN access for keys individually locked in place. Minimum 1,000 system users and 21 iFobs for locking receptors. System shall have a minimum 250,000 audit events screen displayed or ability to be exported via USB port.

1. Manufacturers:

   a. Medeco (MC).
   b. Traka (TA).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Heavy duty mortise locks shall have a ten-year warranty.

2. Manufacturers:

   a. Sargent Manufacturing (SA) - 8200 Series.

B. Multi-Point Locksets: ANSI/BHMA A156.37, Certified Products Directory (CPD) listed vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes.

1. Manufacturers:

   a. Sargent Manufacturing (SA) - 7000 Series.

2.8 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. Manufacturers:

   a. Corbin Russwin Hardware (RU) - ML20900 Series.
   b. Sargent Manufacturing (SA) - 8200 Series.
   c. Yale Commercial(YA) - 8800FL Series.

B. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty, High Security Monitoring): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

3. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.

4. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ML20600 NAC Series.
    b. Sargent Manufacturing (SA) - NAC 8200 Series.

C. Electromechanical Mortise Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Manufacturers:

    a. Sargent Manufacturing (SA) - 7900 Series.

2.9 AUXILIARY LOCKS

A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13 Grade 1 Certified Products Directory (CPD) listed large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 8200 Series.

B. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 2 Certified Products Directory (CPD) deadbolts to fit standard ANSI 161 preparation in functions and with visual status indicators as specified in the hardware sets.

1. Manufacturers:

    a. Corbin Russwin (RU) - DL2200 Series.
    b. Sargent Manufacturing (SA) - 460 Series.
    c. Yale Commercial(YA) - D200 Series.
    d. No Substitution.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as

required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Rim Exit Devices: Exit device rails shall release with less than 5 pounds of pressure per the California Building Code.

9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

11. Extended cycle test: Devices to have been cycle tested to 9 million cycles.

12. Rail Sizing: Provide exit device rails factory sized for proper door width application.

13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

   1. Manufacturers:

      a. Sargent Manufacturing (SA) - 80 Series.

2.12 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.

1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
3. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
4. Manufacturers:
    a. Sargent Manufacturing (SA) - 80 Series.

2.13 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 25-year warranty.
2. Manufacturers:
    a. Norton Rixson (NO) - 7500 Series.
    b. Sargent Manufacturing (SA) - 351 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
    a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
    a. Burns Manufacturing (BU).
    b. Hiawatha, Inc. (HI).
    c. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Burns Manufacturing (BU).
   b. Hiawatha, Inc. (HI).
   c. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

   a. Norton Rixson (RF).
   b. Rockwood (RO).
   c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Reese Enterprises, Inc. (RE).

2.17 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

   a. Securitron (SU) - DPS Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. DHI TDH-007-20: Installation Guide for Doors and Hardware.

3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. MR - Markar
3. SU - Securitron
4. RO - Rockwood
5. SA - SARGENT
6. OT - Other
7. RF - Rixson
8. PE - Pemko

Hardware Sets

Set: 1.0

Doors: 129A, 129B

2	Continuous Hinge	FM300 CTP WEP	630	MR	
2	Electric Power Transfer	CEPT-10		SU	⚡
1	Dust Proof Strike	570	US26D	RO	
1	Concealed Vert Rod Exit, Exit Only	43 5CH 56 MD8610 EO 525	US32D	SA	⚡
1	Concealed Vert Rod Exit, Nightlatch	LC 43 5CH 56 MD8610 106 Less Pull 525	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
2	Pull	RM2120-84 Mtg-Type HD	US32D	RO	
2	Conc Overhead Stop	1-X36	630	RF	
2	Door Closer	351 P10	EN	SA	
2	Drop Plate	As required			
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Rain Guard	346A		PE	
2	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Position Switch	DPS-M-WH		SU	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Doors normally closed and locked with free egress at all times. Valid credential will momentarily unlatch both doors. Doors remain locked with loss of power.

Sound seals by door manufacturer.

Set: 2.0

Description: Not Used

1	Continuous Hinge	FM300 WEP	630	MR
1	Rim Exit Device, Storeroom	LC 16 43 5CH 8804 Less Pull 525	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Pull	RM2120-12 Mtg-Type HD	US32D	RO
1	Conc Overhead Stop	1-X36	630	RF
1	Door Closer	351 P10	EN	SA
1	Drop Plate	As required		
1	Threshold	271A x FHSL14 (verify with details)	Al	PE
1	Rain Guard	346A		PE

1	Sweep	315CN		PE	

Notes: Sound seals by door manufacturer.

Set: 3.0

Doors: 108A, 127A, 128A, 130, 132

1	Continuous Hinge	FM300 CTP WEP	630	MR	
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Conc Overhead Stop	1-X36	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Drop Plate	As required			
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Sound seals by door manufacturer.

Set: 3.5

Doors: 101

1	Continuous Hinge	FM300 CTP WEP	630	MR	
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Conc Overhead Stop	1-X36	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Drop Plate	As required			
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	

1	Frame Harness	QC-C1500		MK
1	Door Harness	QC-C__ (as required)		MK
1	Power Supply	AQDx (fire relay as required)		SU

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Set: 4.0

Description: Not Used

2	Continuous Hinge	FM300 WEP	630	MR
1	Concealed Vert Rod Exit, Nightlatch	LC 43 5CH 56 MD8610 106 Less Pull 525	US32D	SA
1	Concealed Vert Rod Exit, Exit Only	43 5CH MD8610 EO 525	US32D	SA
1	Cylinder	Match Facility Standard		OT
2	Pull	RM2120-12 Mtg-Type HD	US32D	RO
2	Conc Overhead Stop	1-X36	630	RF
2	Door Closer	351 P10	EN	SA
2	Drop Plate	As required		
1	Threshold	271A x FHSL14 (verify with details)	Al	PE
1	Rain Guard	346A		PE
2	Sweep	315CN		PE

Notes:

Set: 5.0

Doors: 108B, 116A

1	Continuous Hinge	FM300 WEP	630	MR
1	Rim Exit Device, Storeroom	LC 16 43 5CH 8804 Less Pull 525	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Pull	RM2120-84 Mtg-Type HD	US32D	RO
1	Conc Overhead Stop	1-X36	630	RF
1	Door Closer	351 P10	EN	SA
1	Drop Plate	As required		
1	Threshold	158A x FHSL14 (verify with details)	Al	PE
1	Sweep	315CN		PE
1	Position Switch	DPS-M-WH		SU

Notes: Sound seals by door manufacturer.

Set: 6.0

Doors: 127B, 128B

2	Continuous Hinge	FM300 WEP	630	MR
1	Multi-Point Lock	AD701015 ETP	US26D	SA
1	Multi-Point Lock	LC AD700615 ETP	US26D	SA
1	Cylinder	Match Facility Standard		OT
2	Pull	RM2120-12 Mtg-Type HD	US32D	RO
2	Conc Overhead Stop	1-X36	630	RF
2	Door Closer	351 P10	EN	SA
2	Drop Plate	As required		
1	Threshold	158A x FHSL14 (verify with details)	Al	PE
1	Rain Guard	346A		PE
2	Sweep	315CN		PE

Notes: Sound seals by door manufacturer.

Set: 7.0

Doors: 117, 118, 119

4	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Rim Exit Device, Storeroom	LC 16 43 5CH 8804 ETP 525	US32D	SA
2	Cylinder	Match Facility Standard		OT
1	Pull	RM2120-84 Mtg-Type HD	US32D	RO
1	Conc Overhead Stop	1-X36	630	RF
1	Door Closer	351 P10	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Threshold	158A x FHSL14 (verify with details)	Al	PE
1	Gasketing	290AS		PE
1	Sweep	315CN		PE
1	Position Switch	DPS-M-WH		SU

Notes: Sound seals by door manufacturer.

Set: 8.0

Doors: 110

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QCx	US26D	MK	⚡
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Electrified Mortise Lock	LC V20 NAC-82280- LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" BEV CSK	US32D	RO	
1	Door Stop	466-RKW	Black	RO	
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Gasketing	290AS		PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Set: 8.5

Doors: 113, 114

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QCx	US26D	MK	⚡
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Electrified Mortise Lock	LC V20 NAC-82280- LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Conc Overhead Stop	1-X36	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" BEV CSK	US32D	RO	
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Threshold	per details	Al	PE	
1	Gasketing	290AS		PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡

1	Door Harness	QC-C__ (as required)		MK
1	Power Supply	158A (fire relay as required)		SU

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Set: 9.0

Doors: 107, 121

1	Continuous Hinge	FM300 CTP WEP	630	MR
1	Electric Power Transfer	CEPT-10		SU
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Door Closer	351 P10	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Mop Plate	K1050 6" high CSK BEV	US32D	RO
1	Door Stop	466-RKW	Black	RO
1	Threshold	158A x FHSL14 (verify with details)	Al	PE
1	Gasketing	290AS		PE
1	Rain Guard	346A		PE
1	Sweep	315CN		PE
1	Frame Harness	QC-C1500		MK
1	Door Harness	QC-C__ (as required)		MK
1	Power Supply	AQDx (fire relay as required)		SU

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Set: 10.0

Doors: 122, 123, 124, 125, 126

1	Continuous Hinge	FM300 CTP WEP	630	MR
1	Electric Power Transfer	CEPT-10		SU
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Conc Overhead Stop	1-X36	630	RF
1	Door Closer	351 P10	EN	SA

1	Kick Plate	K1050 10" BEV CSK	US32D	RO	
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Gasketing	290AS		PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Set: 10.5

Doors: 131A

1	Continuous Hinge	FM300 CTP WEP	630	MR	
1	Electric Power Transfer	CEPT-10		SU	⚡
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Conc Overhead Stop	1-X36	630	RF	
1	Door Closer	351 P10	EN	SA	
1	Kick Plate	K1050 10" BEV CSK	US32D	RO	
1	Threshold	158A x FHSL14 (verify with details)	Al	PE	
1	Gasketing	290AS		PE	
1	Rain Guard	346A		PE	
1	Sweep	315CN		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock active door. Door remains locked with loss of power.

Sound seals by door manufacturer.

Set: 11.0

Doors: 111A, 112A

4	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Classroom Deadlock	LC 8203	US32D	SA	
1	Cylinder	Match Facility Standard		OT	
1	Push Pull Set	110x73C/73CL	US32D	RO	
1	Door Closer	351 O/P9	EN	SA	
1	Kick Plate	K1050 10" BEV CSK	US32D	RO	
1	Mop Plate	K1050 6" high CSK BEV	US32D	RO	
1	Door Stop	441H	US26D	RO	
1	Threshold	271A x FHSL14 (verify with details)	Al	PE	
1	Gasketing	290AS		PE	
1	Sweep	315CN		PE	

Set: 12.0

Doors: 116B, 116C, 116D

4	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Rim Exit Device, Passage	43 5CH 8815 ETP 525	US32D	SA	
1	Door Closer	351 P10	EN	SA	
1	Door Stop	441H	US26D	RO	
1	Threshold	271A x 9" (per details)		PE	
1	Door Bottom	2" per details		PE	
3	Silencer	608-RKW		RO	

Set: 13.0

Doors: 120

3	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QCx	US26D	MK	⚡
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Door Closer	351 O/P9	EN	SA	
1	Door Stop	441H	US26D	RO	
1	Gasketing	S88BL		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Position Switch	DPS-M-WH		SU	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock door. Door remains locked with loss of power.

Set: 13.5

Doors: 131B, 131C

3	Hinge (heavy weight)	T4A3786	US26D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QCx	US26D	MK	⚡
1	Fail Secure Lock	LC RX 8271 LNP	US32D	SA	⚡
1	Cylinder	Match Facility Standard		OT	
1	Door Closer	351 O/P9	EN	SA	
1	Door Stop	441H	US26D	RO	
1	Gasketing	S88BL		PE	
1	Frame Harness	QC-C1500		MK	⚡
1	Door Harness	QC-C__ (as required)		MK	⚡
1	Position Switch	DPS-M-WH		SU	⚡
1	Power Supply	AQDx (fire relay as required)		SU	⚡

Notes: Card reader by integrator

Door normally closed and locked with free egress at all times. Valid credential will unlock door. Door remains locked with loss of power.

Sound seals by door manufacturer.

Set: 14.0

Doors: 106

4	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	LC 8204 LNP	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Door Closer	351 O/P9	EN	SA
1	Door Stop	441H	US26D	RO
3	Silencer	608-RKW		RO

Set: 15.0

Doors: 102, 103, 104, 105

4	Hinge (heavy weight)	T4A3786	US26D	MK
1	Office/Entry Lock	LB LC 8205 LNP	US32D	SA

1	Cylinder	Match Facility Standard		OT
1	Door Stop	441H	US26D	RO
3	Silencer	608-RKW		RO

Set: 16.0

Doors: 109, 115

4	Hinge (heavy weight)	T4A3786	US26D	MK
1	Privacy Lock	LB 49 8265 LNP	US32D	SA
1	Door Closer	351 O/P9	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Mop Plate	K1050 6" high CSK BEV	US32D	RO
1	Door Stop	441H	US26D	RO
3	Silencer	608-RKW		RO

Set: 17.0

Doors: 111B, 112B

4	Hinge (heavy weight)	T4A3786	US26D	MK
1	Classroom Deadlock	LC 8203	US32D	SA
1	Cylinder	Match Facility Standard		OT
1	Push Pull Set	110x73C/73CL	US32D	RO
1	Conc Overhead Stop	1-X36	630	RF
1	Door Closer	351 P10	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Mop Plate	K1050 6" high CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Set: 18.0

Doors: 129C

1	Note	All Hardware by Door Manufacturer		OT

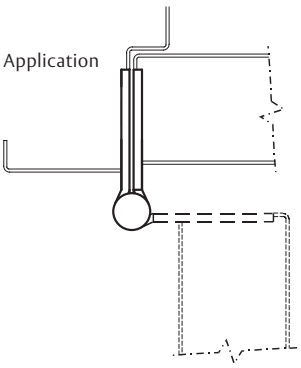
END OF SECTION

Five Knuckle Heavy Weight Full Mortise Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- T4A3386- Stainless steel base or available in brass base material polished
- T4A3786- Steel base material
- For Beveled Edge, where doors are beveled on hinge side, specify T4A4386 or T4A4786
- For available finishes see page 28

T4A3386
T4A3786



Note: 8" x 6" and 8" x 8" have six bearings. Specify T6B3386 or T6B3786.

No.	ANSI Cross Reference	Base Material	Weight
T4A3386	A5111	Stainless	HVY
T4A3386	A2111	Brass	HVY
T4A3786	A8111	Steel	HVY

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2" x 4"	114.3 x 101.6	.180	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.180	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"	127 x 114.3	.190	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.190	8	1/2 x 12-24	1 1/4 x 12
6" x 5"*	152.4 x 127	.203	10	1/2 x 1/4-20	1 1/2 x 14
6" x 6"*	152.4 x 152.4	.203	10	1/2 x 1/4-20	1 1/2 x 14
8" x 6"**	203.2 x 125.4	.203	16	1/2 x 1/4-20	1 1/2 x 14
8" x 8"***	203.2 x 203.2	.203	16	1/2 x 1/4-20	1 1/2 x 14

* Not available in brass base material.
** Available in steel only.
***Available in stainless steel only.
****FT tips not offered on 6" and 8" sizes, BT and ST not offered on 8" sizes.

Options:

Code	Description
NRP	Non-Removable Pin
T4B	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT**	Ball Tip
FT **	Flat Tip
ST**	Steeple Tip
SSF	Safety Stud Feature
RB	Raised Barrel*
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available
CC	Concealed Circuit – 4, 8 or 12 wire available
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

* Refer to page SP-3 for Raised Barrel.

Hinge Pins

Pins, by design, are non-rising.

Two Knuckle

Pins on bearing hinges are furnished in stainless steel.

Three Knuckle

Pin stems in all non-ferrous bearing hinges are stainless steel.
Pins in all ferrous hinges are steel.

Five Knuckle

Pins on all non-ferrous bearing hinges are stainless steel with button tips.

Pins on all ferrous hinges are steel.

Non-Removable Pins

NRP

A set screw is driven into the barrel of the hinge that is inaccessible when the door is in the closed position. To order, add the suffix "NRP" to the hinge number.

NRD

Two knuckle hinges are available with a non-removable pin which features a dowel which is force fitted into the jamb leaf. When the door is hung, the pin is completely concealed and impossible to remove. One doweled hinge is usually furnished per set of three. To order, add the suffix "NRD" to the hinge number.

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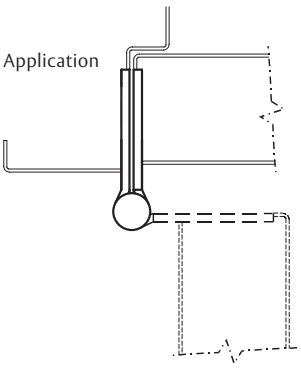
Five Knuckle Heavy Weight Full Mortise Series

Recommended for use on high frequency and/or heavy wood or metal doors in schools, hospitals or other public buildings where heavy traffic is experienced.

- Heavy weight hinges should be used on all extra heavy doors or those exposed to high frequency use
- T4A3386- Stainless steel base or available in brass base material polished
- T4A3786- Steel base material
- For Beveled Edge, where doors are beveled on hinge side, specify T4A4386 or T4A4786
- For available finishes see page 28

T4A3386
T4A3786



Note: 8" x 6" and 8" x 8" have six bearings. Specify T6B3386 or T6B3786.

No.	ANSI Cross Reference	Base Material	Weight
T4A3386	A5111	Stainless	HVY
T4A3386	A2111	Brass	HVY
T4A3786	A8111	Steel	HVY

Specifications

Inches	mm	Gauge	No. of Holes	Fasteners	
				Machine	Wood
4 1/2" x 4"	114.3 x 101.6	.180	8	1/2 x 12-24	1 1/4 x 12
4 1/2" x 4 1/2"	114.3 x 114.3	.180	8	1/2 x 12-24	1 1/4 x 12
5" x 4 1/2"	127 x 114.3	.190	8	1/2 x 12-24	1 1/4 x 12
5" x 5"*	127 x 127	.190	8	1/2 x 12-24	1 1/4 x 12
6" x 5"*	152.4 x 127	.203	10	1/2 x 1/4-20	1 1/2 x 14
6" x 6"*	152.4 x 152.4	.203	10	1/2 x 1/4-20	1 1/2 x 14
8" x 6"**	203.2 x 125.4	.203	16	1/2 x 1/4-20	1 1/2 x 14
8" x 8"***	203.2 x 203.2	.203	16	1/2 x 1/4-20	1 1/2 x 14

* Not available in brass base material.
** Available in steel only.
***Available in stainless steel only.
****FT tips not offered on 6" and 8" sizes, BT and ST not offered on 8" sizes.

Options:

Code	Description
NRP	Non-Removable Pin
T4B	Ball Bearing
TCA	Concealed Bearing
RC	Round Corner – 1/4" radius furnished unless specified otherwise
HT	Hospital Tip
BT**	Ball Tip
FT **	Flat Tip
ST**	Steeple Tip
SSF	Safety Stud Feature
RB	Raised Barrel*
QC	ElectroLynx® Hinge – 4, 8 or 12 wire available
CC	Concealed Circuit – 4, 8 or 12 wire available
CC-18	Concealed Circuit – 2, 4, 6, 8 or 10 wire available (2-18AWG wires and the remainder 28AWG wires)
MM	Magnetic Monitoring

* Refer to page SP-3 for Raised Barrel.

Markar 300 Series Pin & Barrel Type Continuous Stainless Steel Hinges

Short Form Architectural Specification:

Continuous hinges shall be full height piano-type hinge providing full height door support.

- Supports weights up to 600 lbs. 4' 0" maximum door width
- Material to be 14 gauge Stainless Steel
- .187" diameter Stainless Steel pin (rod)
- Exterior barrel diameter .438" ($^{7}/_{16}$")
- Each knuckle 2", including nylon bearing at each separation for a quiet, smooth, self-lubricating operation
- Finish: US32D Satin Stainless Steel (630)
  Optional Finish: US32 Bright Stainless Steel (629), Scratch-Resistant Powder Coated Paint.
- All hinges shall be furnished with manufacturer's recommended hardware pack per specific model application
- Must be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours
- Hinges shall meet ANSI/BHMA Standard A 156.26 Grade 1
- Symmetrically templated hole pattern

Note: 25-Year Warranty on Continuous Pin & Barrel Hinges

Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames

Markar FM300 Edge Mount Hinge

Standard Features

Barrel Type Hinge
.187" diameter Stainless Steel pin (rod)
Medical bearings
Stainless Steel end pins

Material
Heavy-duty 14 gauge Stainless Steel

Finishes
US32D Satin Stainless Steel (630)

Standards
ANSI/BHMA Standard A156.26 Grade 1

Hole Pattern
Symmetrically templated

Mounting Hardware
Fasteners concealed when door is closed
Custom 12-24 x $^{11}/_{16}$" S.S Phillips Flat Head Undercut TEK Screws

Capacity
Supports weights up to 600 lbs.
4'0" maximum door width

Standard Sizes
6'8", 7'0", 7'2", 8'0", 10'0"

Handing
Handing not required on standard hinges. Specify handing when ordering a hinge with modification.

Rating
3 hours- hollow metal doors
90 minutes- hollow metal and composite core wood fire doors
20 minutes- wood doors

Classified in accordance with UL10C for positive pressure

Fire-rated label

Windstorm
Evaluated in accordance with TAS 201-94, TAS 202-94, TAS 203-94, ASTM E330, ASTM E1886, ASTM E1996 and ANSI A250.13

Optional Features

Finishes
Scratch-Resistant Powder Coated Paint

Fasteners
Tamper-proof security screws

Other Features
Custom lengths- specify in inches
Custom hole pattern

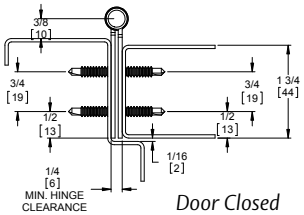
Dutch door hinges- suffix "DDP"
Hospital tips - suffix "HT"
Raised barrel - suffix "RB"
Welded end pins
Security studs.

Electrical Modifications
Adjustable Monitoring Switch - "AMS"

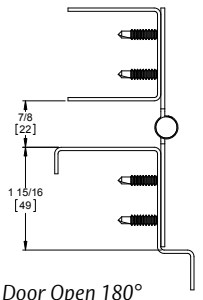
Current Transfer Prep - suffix "CTP"
Electrical Transfer Access Prep - suffix "ETAP"

ElectroLynx®
EL4 (4 wire), EL8 (8 wire), EL12 (12 wire)

This edge-mounted pin & barrel hinge is used on many of today's high traffic, high abuse doors. The hinge works well in locations that would normally call out for anchor hinges, pivot reinforcement hinges or thrust pivot unit and hinge sets. This hinge saves on special door and frame preparation charges and makes the installer's job easier. It can be used on both fire labeled and non-labeled openings.



Door Closed



Door Open 180°

ASSA ABLOY

The global leader in door opening solutions

POWER
»PRODUCTS

SECURITRON®
ASSA ABLOY

ASSA ABLOY, the global leader in door opening solutions

CEPT
Concealed Electrical Power Transfer

Beautifully Crafted, Compact, Secure Power Transfer

The heavy-duty, tamper-resistant Concealed Electrical Power Transfer (CEPT) securely transfers power and data from the hinge side of the frame to electrified hardware on the door. The unit is discreetly concealed between the frame and door when the door is closed. Available in three multi-wire configurations and four finishes, the CEPT complements any architectural setting.

PRODUCT FEATURES

- Mortises into the edges of the door and frame
- Direct retrofit for competitor products
- Tamper resistant
- All metal construction including back boxes
- 7/8" knockouts on back boxes accommodate EMF-type fittings
- Tested to 1,000,000 cycles
- Compatible with butt hinges up to 6" and continuous hinges with cutout
- MagnaCare® lifetime replacement, no fault warranty

PRODUCT OPTIONS

- CEPT-10 includes 8-22 AWG wires plus 2-18 AWG wires for higher-current devices
- CEPT-C5E includes CAT5E compatible with 9 - 22 AWG wire stranded conductor, Molex connectors
- EL-CEPT is ElectroLynx® compatible with 12-22 AWG wires, ElectroLynx® connectors

SPECIFICATIONS

- ANSI/UL 10C Listed, 3 hour rated
- ULC-S318 Listed, 3 hour rated
- ANSI/SDI-BHMA A250.13 (+/- 150 psi) Windstorm Listed
- Florida Building Code Approved
- Patents: 8,448,382; 2,714,685 (Canada)

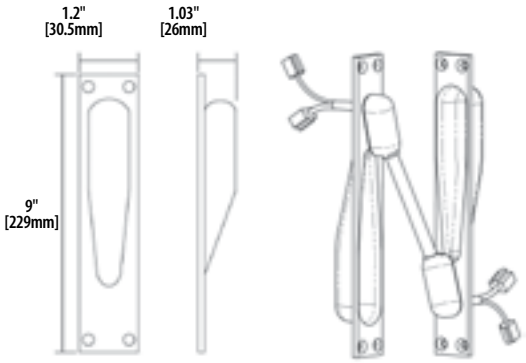
Dimensions:
CEPT Housing
9-1/16"L x 1-3/16"W x 1-7/16"D

Shipping Weight:
2.40 lbs [1.09kg]

Finishes:
US32D/630 - Stainless Steel
US04/606 - Dull Brass
US10/612 - Dull Bronze
US10B/613 - Oil Rubbed Bronze

MODELS

PART #	Description
CEPT-10	CEPT - US32D, Concealed, 10 Wires
CEPT-10-04	CEPT - US04/606, Concealed, 10 Wires
CEPT-10-10	CEPT - US10/612, Concealed, 10 Wires
CEPT-10-10B	CEPT - US10B/613, Concealed, 10 Wires
CEPT-C5E	CEPT - US32D, Concealed, CAT-5E
CEPT-C5E-04	CEPT - US04/606, Concealed, CAT-5E
CEPT-C5E-10	CEPT - US10/612, Concealed, CAT-5E
CEPT-C5E-10B	CEPT - US10B/613, Concealed, CAT-5E
EL-CEPT	CEPT - Concealed, US32D, ElectroLynx®
EL-CEPT-04	CEPT - Concealed, US04/606, ElectroLynx®
EL-CEPT-10	CEPT - Concealed, US10/612, ElectroLynx®
EL-CEPT-10B	CEPT - Concealed, US10B/613, ElectroLynx®
CEPT-NW	CEPT - Without Wires



Technical note:
- Not for use with center hung or balanced doors, pocket or offset pivots or swing clear hinges.
- Door swing ranges when installed with butt hinges are :

Hinge Size	Door Swing Range
5" or less	up to 180
5-1/2"	up to 130
6" Butt Hinge	up to 110

FIRE RATED
ANSI A250.13-2003 WINDSTORM RESISTANT
MAGNACARE WARRANTY
LISTED

SECURITRON
ASSA ABLOY

Lever Extension Flush Bolt With Bottom Fire Bolt No. 557 x 19BFB

Material: Flush bolt – brass
Bottom fire bolt – stainless steel

Finishes: Available in standard architectural finishes (see page 9)

Fastener: 7 ea. #8 x 3/4" FH combo screws
4 ea. #8 - 32 x 1/2" FH MS
4 ea. #8 counter sunk washer

Features:
- For Fire Rated Plastic & Wood Covered Fire Doors measuring up to 4'w x 9'h rated up to 20 minutes
- 3/4" bolt throw, 3/4" backset; door strength maintained by corner reinforcing plate
- When door is subjected to 230°F the plug and black plastic cover will melt allowing the bolt to project, locking the leaves together
- Bottom fire bolt eliminates need for floor prep
- Oversize fire bolt strike hole allows for slight door misalignment

No.	Size	Weight
557 x 19BFB	Top bolt: 1" x 6 3/4" Bottom bolt: 13/16" dia.	0.9 lbs.

Dust Proof Strike No. 570

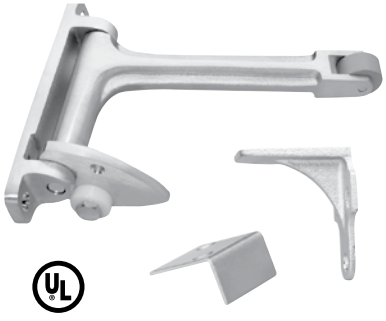
Material: Brass

Finishes: Available in standard architectural finishes (see page 9)

Fastener: Adjustment nut
Spanner wrench
2 ea. #8 x 1 OH SMS, 2 ea. plastic anchors
2 ea. #8 - 32 x 3/4" OH MS, 2 ea. lead anchors

Features:
- Works with all Rockwood manual and automatic flush bolts
- Removable face plate for use with thresholds
- Adjustable height for carpeted areas

No.	Size	Weight	ANSI A156.16
570	Face plate: 1 3/8" x 2 7/8" Barrel: 7/8" dia. x 2" depth	0.4 lbs.	L04021



Gravity Door Coordinator No. 576

Material: Cast brass

Finishes: Available in standard architectural finishes (see page 9).

Fastener: Body: 2 ea. #10 x 1" FH SMS, 2 ea. #10 - 24 x 1" FH MS
Strike: 5 ea. #8 x 1" FH SMS

Other:
- For use on door sizes:
  - with Astragal on active door – 18" to 48"
  - with Astragal on inactive door – 18" to 34"
  - with Astragal on both doors – 18" to 30"
- The overlap of the astragal is maximum 7/8" with door hung on standard hinges. Customer must contact the factory for all other astragal situations

Features: Non-handed reversible. Prevents the active door from closing until the inactive door is closed

No.	Size	Projection	Weight	ANSI A156.3
576	1" x 5 7/16"	7"	2.2 lbs.	Type 21

ASSA ABLOY

The global leader in door opening solutions

Product Catalog

SARGENT
ASSA ABLOY

7800/8200 Series
Mortise Locks

ASSA ABLOY, the global leader
in door opening solutions

Specifications & Certifications

8200/R8200/7800 Mortise Locks

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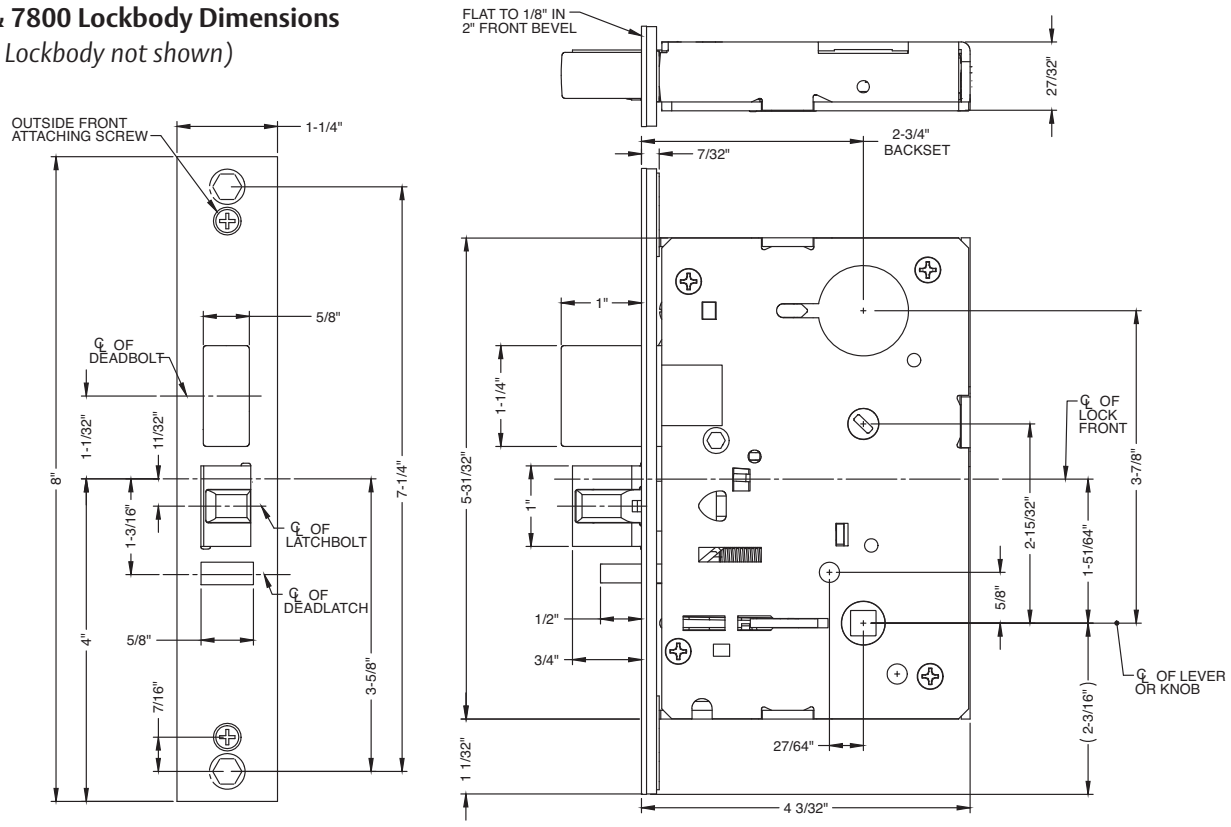
Certification Compliance

ANSI/BHMA	Certified to ANSI/BHMA A156.13 Series 1000 Operational Grade 1 and Security Grade 1 with all standard trims. ANSI/ASTM F476-84 Grade 40 with concealed mortise cylinder. **Note:** LFIC (Removable) Cylinders and SFIC Cylinders do not meet Security Grade 1 requirements.
ADA	Meets A117.1 Accessibility Code. Meets BOMA International 4.13.8 Complies with American Disability Act; Consult local authorities
UL-cUL	UL and cUL Listed to US and Canadian safety standards for A label 4 x 10 single and 8 x 10 double (3 hour fire door) and lesser class doors, stamped letter F and UL symbol on armored front indicate listing
Positive Pressure	Meets ANSI/UL 10C, Positive Pressure Fire Test of Door Assemblies
California	California State Reference Code (Formerly Title 19, California State Fire Marshal Standard) All levers with returns comply; levers return to within 1/2" (13mm) of door face
Tornado and Hurricane Codes	See page 4

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

8200 & 7800 Lockbody Dimensions

(R8200 Lockbody not shown)



Note: R8200 and 8200 lockbodies are dimensionally the same except for the through-bolt locations

Explanation of the 8200/7800 Lockbody types:

Lockbody Type[1]	Trim Available x Lockbody type	Standard 8200 Door Prep	Through Bolted Trim	Multi-function lockbody available	How to order lockbody only
8200	Lever x Rose/Escutcheon	Yes	Yes	Yes	82 x Function x Finish[3]
7800	Knob x Rose/Escutcheon	Yes	Yes	Yes	78 x Function x Finish[3]
R8200	Simpli™ roseless trim	No	Yes[2]	Yes	R82 x Function x Finish[3]
8200 for ALP	ALP Push/Pull Trim	Yes	Yes	Yes	Six Digit Part # determined by function*
7800 PT	PT Push/Pull Trim	Yes	Yes	Yes	Six Digit Part # determined by function*

[1] Lockbodies can only be used with the specified trim
[2] Through Bolt locations are different from standard trim, special door prep required
[3] **Note:** Cylinder and trim not included. Outside front, strike and screw pack are included
* See Price book; **Note:** Outside Fronts, Strikes, Cylinders and Trim are NOT included

Windstorm Certifications

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Windstorm Certifications: Florida Building Codes & UL Listings

SARGENT Manufacturing's products meet building codes that require hurricane, windstorm and FEMA certifications, including some of the most stringent building codes as specified in the Florida Building Code, Miami Dade Code and the International Building Code. Listed below are certifications and standards met by the 7800/8200 lock.

Florida Building Code: FL2998
UL Certification Directory: ZHEM.R21744 – Latching Hardware

ANSI/SDI-BHMA A250.13	"Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies"
ANSI/ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
(TAS) 201	"Impact Test Procedures"*
(TAS) 202	"Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure"
(TAS) 203	"Criteria for Testing Products Subject to Cyclic Wind Pressure Loading"*

* Published in the "Florida Building Code"

UL Certification Directory: ZHLL.R21744 – Products for Use in Windstorm-rated Assemblies

Certifications to meet assembly requirements are done in conjunction with doors from ASSA ABLOY Group companies CECO DOOR and CURRIES.

ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
AAMA/WDMA/CSA 101/I.S.2/A440	"Standard/Specification for Windows, Doors, and Unit Skylights"

Thumbturn Designs

8200/R8200/7800 Mortise Locks

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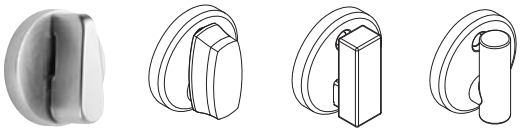
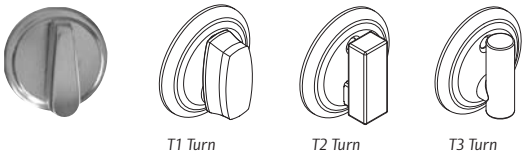
130KB Round Backplate
(Shown with Standard Turn)



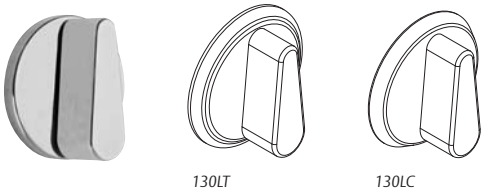
- Round backplate supplied standard with L, O, LN roses and R8200 roseless trim
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-1/2" (38mm) round brass or stainless steel plate
- Meets ADA Requirements

130KT Traditional Backplate
(Shown with Standard Turn)



- Dual radii edge backplate supplied standard with TO and TR roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-3/4" (44mm) round brass plate
- Meets ADA Requirements

130LB Large Round Backplate
(Shown with Large ADA Turn)

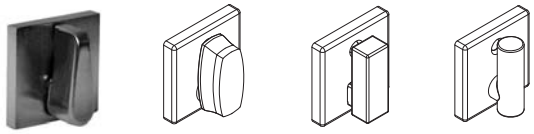


- Available with R8200 & 8200 with sectional trim
- 40% larger than standard thumbturn
- Specify LB as an option for ADA turn
- 2" (51mm) round brass, zinc, or stainless steel plate & turn
- 130LT - Traditional backplate, 130LC — Contemporary backplate
- Meets ADA Requirements

126 T-Turn
(7892 function only)

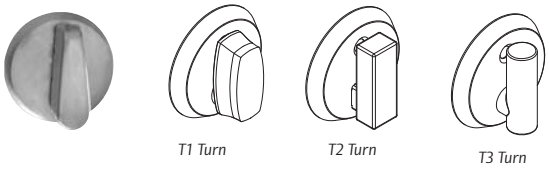
- 2-3/16" (56mm) round stainless steel backplate
- 2-3/8" (61mm) tall thumbturn
- Available in brass or bronze finishes only
- Surface mounted with three screws
- Order as "SST" trim with 7892 function

130KA Square Backplate
(Shown with Standard Turn)



- Square backplate supplied standard with E, E2, E3 or E4 roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-1/2" (38mm) round brass or stainless steel plate
- Meets ADA Requirements

130KC Contemporary Backplate
(Shown with Standard Turn)



- Beveled edge backplate supplied standard with CO and CR roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-3/4" (44mm) round brass or stainless steel plate
- Meets ADA Requirements

130KBHA Turn for use with 8200 Mortise BHW, ALP, BHL and BHD Trim

- 3-3/4" x 2-1/2" rectangular shape
- Stainless steel housing
- Meets ADA and OMH Requirements

130W Round Backplate
(Shown with Standard Turn)

- Used with 7800 with sectional trim
- 1-1/2" (38mm) round brass or stainless steel plate

Emergency Releases & Accessories

8200/R8200/7800 Mortise Locks

SARGENT®
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Emergency Releases

184KB Emergency Release (used with R8200 & 8200 with sectional trim)

- 1-1/2" (38mm) round brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

Studio Collection Emergency Release

- 184KC Emergency Release Contemporary
- 184KT Emergency Release – Traditional

184W Emergency Release (used with 7800 with sectional trim)

- 1-1/2" (38mm) round brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

184KA Emergency Release (used with E rose)

- 1-1/2" (38mm) square brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

Emergency Key 14-0057

- Carbon steel
- For 65, 66 and 68 functions only
- Must be ordered separately

184KBHA Emergency Release (used with BHW, ALP, BHL and BHD trim)

- 3-3/4" x 2-1/2" rectangular shape
- Stainless steel housing
- Meets ADA and OMH Requirements

Accessories

130KBCVR Cap

- Thumbturn plate
- Covers hole in door when thumb turn is no longer needed

82-4023 Cap

- 2" round
- Covers hole for levers and roses

Door Thickness	Part Number
1-3/8"	82-4022
1-3/4"	82-4023
2"	82-4024
2-1/4"	82-4025

Trim One Side Kit

Refer to page 42 for a complete list of kits

Indicators and Escutcheon Engraving

8200/R8200/7800 Mortise Locks

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Sectional Trim - Indicators

49- Option Visual Status Indicator for Non Secure Applications

- Designed to work with Classroom security functions
- Red/White indicator plate standard
- Mounts on inside of door
- Functions and Roses available:
  – 30, 36 & 37 Functions with 7800, 8200 and R8200 locks, CR, L, LN, TR, E & O Roses
  – 26, 29, 38, 39, 40 and 41 Functions with 7800, 8200, and R8200 locks & LN Roses Only
- As retrofit, order 185C x finish

Inside Only

185C

49- Option Occupancy Indicator with Emergency Release

- Ideal for restrooms or conference rooms where easy determination of use needs to be made
- OCC/VAC indicator plate standard
- Mounts on outside of door
- Emergency coin operated release standard
- Functions and Roses available:
  – 65, 66, 68 Functions with 7800, 8200, and R8200 locks, CR, E, L, LN, O & TR Roses
- As retrofit, order 185P x finish

185P

50- Option Secured Indicator Rose

- Non-handed with lever and mounting posts field reversible
- VAC/OCC indicator plate standard
- Mounts on outside of door
- Available for the following functions: 24, 25, 26, 28, 29, 30, 36, 37, 38, 39, 40, 41, 43, 45, 50, 51, 52, 57, 58, 67 - with Rose Trim only
- Patent pending design
- Not available with Roseless trim (R8200)
- For retrofit, order 185S x suffix x finish:

Suffix	Door Thickness
-1	1-3/8" (35mm)
-2	1-3/4" (44mm)
-3	2" (51mm)
-4	2-1/4" (57mm)

Note: For 49- and 50- Options, key will not retract latch when used with 37 and 38 functions

Escutcheon Trim - Indicators

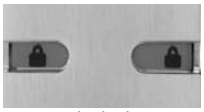
- Red/white plate with locked/unlocked icons
- Available with LE1/KE1 Escutcheons only
- Available finishes: 03, 04, 09, 10, 10B, 10BE, 10BL, 14, 15, 20D, 26, 26D, 32, 32D, BSP, WSP
- Available with MicroShield®
- Windows allow 180° view
- See chart for function availability

Options:

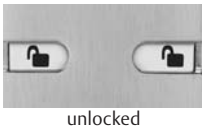
VNA - Indicator located on outside of door

VNB - Indicator located on inside of door

VNC - Indicator located on inside and outside of door



locked



unlocked

Escutcheon Trim - Engraving

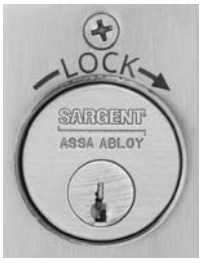
- Laser engraving with "LOCK" and directional arrow
- Available with LE1/KE1 Escutcheons only
- Available finishes: 03, 04, 14, 15, 26, 26D, 32, 32D
- Available with MicroShield®
- Door handing must be specified
- See chart for function availability

Options:

EMA - Engraving located on outside of door

EMB - Engraving located on inside of door

EMC - Engraving located on inside and outside of door



Note: If indicators and engraving are ordered together, finish offering is limited to 03, 04, 14, 15, 26, 26D, 32, 32D

		Function																									
		Single Cylinder w/o Deadbolt							Single Cylinder w/ Deadbolt									Double Cylinder w/o Deadbolt	Double Cylinder w/ Deadbolt							Deadbolt Only		
Option	**Description**	**05**	**36**	**37**	**56**	**57**	**58**	**67**	**24**	**25**	**28**	**30**	**43**	**45**	**47**	**50**	**51**	**38**	**26**	**29**	**39**	**40**	**41**	**46**	**52**	**20**	**21**	**22**
VNA	Outside Indicator	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
VNB	Inside Indicator			X														X	X	X	X	X	X	X	X			X
VNC	Indicator Both Sides			X														X	X	X	X	X	X	X	X			X
EMA	Outside Engraving	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EMB	Inside Engraving																	X*	X	X	X	X	X	X	X			X
EMC	Engraving Both Sides																	X	X	X	X	X	X	X	X			X

* Provided as standard. Inside engraving option (EMB) is not required when ordering this function. Handing must be specified.

Cylinders

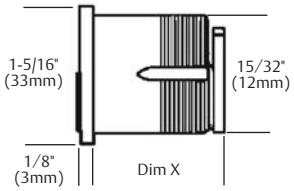
8200/R8200/7800 Mortise Locks

Cylinder Lengths (Dim X)

Cylinder No.	41	42	43	44	46	48	50	52	54	56
Dim X Length Under Cylinder Head	1-1/8" (29mm)	1-1/4" (32mm)	1-3/8" (35mm)	1-1/2" (38mm)	1-3/4" (44mm)	2" (51mm)	2-1/4" (57mm)	2-1/2" (64mm)	2-3/4" (70mm)	3" (76mm)

40 Series Type Cylinder

- Cylinder body: Solid brass
- Cap: Brass, bronze or stainless steel
- All functions take a Standard Cam Functions
- Standard Cam 13-0664
- 16 & 92 Inside Cam -105
- 50 Hotel Cam -115 supplied standard with all Hotel Function Cylinders



7850/8250 Function Hotel Cylinder

- When door is locked by deadbolt, only emergency key is able to unlock
- Must request emergency key separately (14-0036 x keying info)
- Supplied with Cam suffix -115 for Hotel Functions

10- Option Signature Series

- The protected system offers the building owner full control over duplication of keys. Highly pick-resistant cylinders
- 10-63- Option — Signature cylinder with Large Format Interchangeable Cores

F1-82- and 82- Option KESO

- The system offers the building owner full control over duplication of keys
- Highly pick-resistant cylinders
- Expanded levels of masterkeying
- F1-83- & 83- Option — Keso removable core
- 84- Option — Keso construction core cylinder

78- Option Exposed Barrel

- Standard for use only with SARGENT Escutcheon Trims KE3, KE4, LE3, LE4
- Available 6-Pin standard or 7-Pin optional
- NOT available with 50-, 60-, 70- or other specialty or higher security options
- See function table for cam required
- Not available in 50 function
- Plug finishes: 4, 15 (similar to 26 finish)

11- Option XC Key System

- Patented system works with existing SARGENT keyway adding increased security
- 11- XC standard cylinder
- 11-63- Large format interchangeable core
- 11-73- Small format interchangeable core

124 Series Mortise Cylinder Turn Lever

- Turn lever: Brass, bronze or aluminum
- Cap: Brass, bronze or stainless steel
- Must be ordered separately

DG1, DG2, DG3 - Degree Series

- Utility patented, bump resistant and requires the use of a patented key
- All three locking mechanisms within the same system to be operated with just one key
- See Degree Key System Catalog for available options

For complete cylinder information, see Cylinders & Components, Degree, Signature, Keso, Keso F1 or XC catalogs.

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51- Option Old Style Removable Core

- Available for **existing systems only** Permanent Removable Cores
- Control key used to remove core, must request control key separately

60- or 70- Option Plastic Construction Core

- For doors that do not require key locking during the construction period
- Operate with coin or flat screw driver
- For use with LFIC (removable) (60- Option) or SFIC (70- Option) core

63- Option Large Format Interchangeable (Removable) Core

- Allows immediate removal of the core. Virtually unlimited key changes
- Available 10-63-, 11-60-, 11-63- & 11-64-
- For disposable core, see 60- Option
- 64- Option- LFIC 6-Pin construction core
- Control key used to remove core, must request control key separately

7300B Interchangeable Core

- Small Format Interchangeable Core
- SARGENT Interchangeable Core cylinders and MasterKey Systems are available for increased security through quick change of keying. It is unnecessary to remove a cylinder
- SARGENT 7300B Interchangeable Cores are available in SARGENT 4A and 4B keyways, as well as the following standard competitor keyways: A, B, C, D, E, F, G, H, J, K, L, M
- For disposable core, see 70- Option
- 65-73 Option — 6-Pin Small Format Interchangeable Cores-uncombinated
- 65-73-7P Option — 7-Pin Small Format Interchangeable Cores-uncombinated
- 70- Option — Small Format Interchangeable disposable core
- 72- Option — Small Format Interchangeable construction core
- 11-72- Construction core provided for use with 11-7300 cylinder housing

  11-70- temporary plastic core prepared to accept 11-7300 core
- 73- Option — 6-Pin Small Format Interchangeable core, SARGENT 4A, 4B keyways
- 73-7P Option — 7-Pin Small Format Interchangeable core, SARGENT 4A, 4B keyways
- Control key used to remove core (provided separately)

1SB Cylinder Collar

- Standard for 7800 BHD, 8200 BHL & BHW mortise locks
- Stainless steel
- 1-29/32" diameter
- Finishes: 32, 32D
- Available in 4 sizes. See page 36 for specifics on collar sizes and measurements

21- Option Lost Ball Construction System

- The SARGENT construction keying system protects the building owner by providing temporary masterkeying during the construction period

1KB Rosette with 8200 & R8200 sectional trim

- Used with mortise cylinders and No. 90 blocking rings when cylinders project from door
- Furnished standard with L, O, LN, CO, CR, TO and TR roses
- Brass, bronze or stainless steel
- 1-1/2" (38mm) diameter, includes compression spring
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP
- Projection from door:

1KB-1	5/16" (8mm) — Standard
1KB-2	7/16" (11mm)
1KB-3	9/16" (14mm)

IKA Rosette with 8200 sectional trim

- Used with mortise cylinders
- Furnished standard with the E, E2, E3 and E4 roses
- Brass, bronze or stainless steel
- 1-1/2" (38mm) Square, includes compression spring
- Projection from door:

1KA-1	5/16" (8mm) — Standard
1KA-2	7/16" (11mm)
1KA-3	9/16" (14mm)
1KA-4	11/16" (16mm)

- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

No. 97 Rosette

- Standard for cylinders ordered separately from hardware
- Standard for 7800 knob mortise & 4870 deadbolt
- Brass, bronze or stainless steel
- 1-11/16" diameter (43mm), 9/32" (7mm) projection, includes compression spring
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 32, 32D, BSP, WSP

No. 90 Blocking Ring

- Used with 1KB rosettes as spacer when mortise cylinder projects from face of door
- Brass, bronze or stainless steel
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

1KB-5 Cylinder Retaining Cap

- Required for double cylinder functions on KS and LS Escutcheon *only*
- Steel or stainless steel
- 1-15/32" (37mm) diameter
- 9/16" (14mm) projection
- Finishes: 3, 4, 9, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

Cylinders Requirements & Cams

8200/R8200/7800 Mortise Locks

SARGENT®
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Single Cylinder

Sectional Trim (CO, CR, L, LN, O, PT, SL, SN, TO, TR)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-2	1KB-1	1KB-1	1KB-1
42	1KB-3	1KB-2	1KB-2	1KB-1
43	1KB-4	1KB-3	1KB-3	1KB-3

Sectional Trim (E, E2, E3, E4)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KA-2	1KA-1	1KA-1	1KA-1
42	1KA-3	1KA-2	1KA-2	1KA-1
43	1KA-4	1KA-3	1KA-3	1KA-3

Escutcheon Trim (CE, KE1, KE2, KW1, LE1, LE2, LW1, TE)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-1	Cylinder Only	Cylinder Only	Cylinder Only
42	1KB-2	1KB-1	Cylinder Only	Cylinder Only
43	1KB-3	1KB-1	1KB-1	Cylinder Only

Escutcheon Trim (WT)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	97	Cylinder Only	Cylinder Only	Cylinder Only
42	1SB-2	97	Cylinder Only	Cylinder Only
43	1SB-3	97	97	Cylinder Only

Specialty Hardware (BHW, BHL, BHD, ALP)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-2	1SB-1	1SB-1	1SB-1
42	1SB-3	1SB-2	1SB-2	1SB-1
43	1SB-4	1SB-3	1SB-3	1SB-3

Double Cylinder

Sectional Trim (CO, CR, L, LN, O, PT, SL, SN, TO, TR)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-3	1KB-2	1KB-1	1KB-1
42	1KB-4	1KB-3	1KB-2	1KB-1
43	97-0352	1KB-4	1KB-3	1KB-2

Sectional Trim (E, E2, E3, E4)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KA-3	1KA-2	1KA-1	1KA-1
42	1KA-4	1KA-3	1KA-2	1KA-1
43		1KA-4	1KA-3	1KA-2

Escutcheon Trim (CE, KE1, KE2, KW1, LE1, LE2, LW1, TE)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-2	90 1/8	Cylinder Only	Cylinder Only
42	1KB-3	1KB-2	1KB-1	Cylinder Only
43	1KB-4	1KB-3	1KB-2	90 1/8

Escutcheon Trim (WT)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-2	97	Cylinder Only	Cylinder Only
42	1SB-3	1SB-2	97	Cylinder Only
43	1SB-4	1SB-2	1SB-2	97

Specialty Hardware (BHW, BHL, BHD, ALP)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-3	1SB-2	1SB-1	1SB-1
42	1SB-4	1SB-3	1SB-2	1SB-1
43	1SB-4	1SB-4	1SB-3	1SB-2

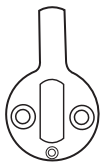
Cylinder Cams For Mortise Locks

SARGENT Conventional Cylinders

- Standard

Std Cam (13-0664) for all functions except for 50 and the Inside cam for 16 & 92 function locks

-105 Cam (13-0665) 16 & 92 Function Inside Cylinder Cam



-115 Cam (13-2045) 50 Function Hotel Cam, supplied with 50 function cylinders

See Cylinder catalogs for additional information

SARGENT Large Format Interchangeable Core Cylinders

- 6300 Cams are factory installed and are not removable
- 6300 Cams are not sold separately
- Specify required Cam as a suffix: 63-44-105 cam
- For Standard Cam: no suffix is required

Std 6300 Cam for all functions except for 50 and the Inside cam for 16 & 92 function locks

-105 Cam for 6300 Series 16 & 92 function I/S Cylinder

-115 Cam for 6300 Series 50 (Hotel) function, supplied with 50 function cylinders

Mechanical Options

8200/R8200/7800 Mortise Locks

SARGENT®
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Mechanical Options:

Available mechanical options by lock type

Categories	How to Specify	Detailed Description	8200	R8200	7800
1-3/8" Door	1-	1-1/16" (27mm) wide front for 1-3/8" (35mm) doors (not available with RX-Option) (1- for 93 + 94 function is a special order)	X	-	X
Add Strength	3-	Stainless steel hubs with in the mortise lock	X	-	
Strike Option	23-	4-7/8" (124mm) ANSI flat lip strike	X	X	X
	OBS-	Open back strike	X	X	X
	WBS-	Wrought box strike	X	X	X
Thick Doors	31-	For doors 1-7/8" (48mm) to 2-1/4" (57mm) thick — see cylinder options for limitations on door thickness. When ordering the following information is required: Location of lock within the door, door thickness -IF PANELED -must specify panel thickness & panel location (inside or outside of the door) For doors thicker than 2-1/4" — consult factory.	X	X	X
Security Fasteners	36-	6 Lobe head security screws (Torx® type)	X	-	X
	37-	Spanner head security screw (not available with Studio levers)	X	-	X
Visual Indicators	49-	Visual Status Indicator or Occupancy indicator with emergency release (not available with escutcheon trim; see page 16 for details)	X	X	X
	50-	Secured indicator rose (available with rose trim only; see page 16)	X	-	X
	EMA	Engraving, Outside (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	EMB	Engraving, Inside (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	EMC	Engraving, Both Sides (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	VNA	Visual Status Indicator, Outside (Escutcheon trim LE1/KE1 only)	X	-	X
	VNB	Visual Status Indicator, Inside (Escutcheon trim LE1/KE1 only)	X	-	X
	VNC	Visual Status Indicator, Both Sides (Escutcheon trim LE1/KE1 only)	X	-	X
Electrical Options	DX-	Deadbolt monitoring — Monitor deadbolt position (not available with LX-)	X	X	X
	LX-	Latchbolt monitor — Monitors latchbolt position (not available with deadbolt functions)	X	X	X
	RX-**	Request to Exit — Monitors each lever independently (not available with LB-option)	X	X	X
	TL-	SARGuide illuminated inside WT trim with the word EXIT illuminated (4-1/2" pocket depth required)	X	-	-
Lever/Knob Combination	68-	8200 Lock furnished w/lever handle outside x knob inside (not available with the AV-Option or FE Trim)	X	-	-
	69-	8200 Lock furnished w/lever handle inside x knob outside (not available with the AV-Option or FE Trim)	X	-	-
Lead Lining	74-**	Lead lining or wrapping available with sectional trim only (not available with DX-or LX- Options)	X	-	X
Tactile Warnings	75-	Tactile Warning — Milled levers or knurled knobs. Inside trim only (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	76-	Tactile Warning — Milled levers or knurled knobs. Outside trim only (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	77-	Tactile Warning — Milled levers or knurled knobs. Inside & outside trim (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	85-	Tactile Warning — Abrasive coating inside trim only (not available with D knobs)	X	X	X
	86-	Tactile Warning — Abrasive coating outside trim only (not available with D knobs)	X	X	X
	87-	Tactile Warning — Abrasive coating inside & outside trim (not available with D knobs)	X	X	X
Anti-Vandal Trim	AV-	Anti-Vandal pull trim (not available with LS & FE trim and Options 1-, 31-, 49-, 50-, 68-, 69-, 76-, 77-, 86-, 87-, DX-or SG-)	X	-	X
Finish Protection	CPC-	Clear Powder Coat (available for 32 & 32D finishes)	X	X	X
	SG-*	MicroShield® antimicrobial clear powder coat	X	X	X
Thumbturns (See page 14)	LB-	ADA Extra large thumbturn; backplate matches rose design chosen	X	X	X
	T1-	Decorative thumbturn; backplate matches rose design chosen	X	X	-
	T2-	Decorative square thumbturn; backplate matches rose design chosen	X	X	-
	T3-	Decorative cylinder thumbturn; backplate matches rose design chosen	X	X	-

* Available on 15, 26D, and 32D Finishes only

** Not available in combination

Cylinder Options

8200/R8200/7800 Mortise Locks

SARGENT®
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Cylinder Options:

Categories	How to Specify	Detailed Description	Cylinder Sizes Available
Conventional Cylinder		SARGENT Conventional Cylinders supplied standard	41-44,46,48,50,52,54,56
Degree Key System	**DG1-**	SARGENT Degree Key System Level 1 (bump resistant with patented keys)	41-44, 46
	DG1-21-*	Degree Level 1 Construction Master Keying	41-44, 46
	DG1-60-	Degree Level 1 Removable Disposable Construction Core	41-44, 46
	DG1-63-	Degree Level 1 Removable Core	41-44, 46
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC	41-44, 46
	DG1-65-*	Degree Level 1 Unassembled/Uncombined Core	41-44, 46
	DG1-78-*	Degree Level 1 Exposed Plug (for use with LE3/LE4 escutcheons only)	41-43
	DG2-*+	SARGENT Degree Key System Level 2 (geographically exclusive; bump and pick resistant)	41-44, 46
	DG2-21-*	Degree Level 2 Construction Master Keying	41-44, 46
	DG2-60-*	Degree Level 2 Removable Disposable Construction Core	41-44, 46
	DG2-63-*	Degree Level 2 Removable Core	41-44, 46
	DG2-64-*	Degree Level 2 Removable Construction Keyed LFIC	41-44, 46
	DG2-65-*	Degree Level 2 Unassembled/Uncombined Core	41-44, 46
	DG3-*+	SARGENT Degree Key System Level 3 (geographically exclusive; UL437 certified; bump and pick resistant)	41-44, 46
	DG3-21-*	Degree Level 3 Construction Master Keying	41-44, 46
	DG3-60-*	Degree Level 3 Removable Disposable Construction Core	41-44, 46
	DG3-63-*	Degree Level 3 Removable Core	41-44, 46
	DG3-64-*	Degree Level 3 Removable Construction Keyed LFIC	41-44, 46
Signature Key System	**10-***	SARGENT Signature Key System (not available with other key systems)	41-44,46,48,50,52,54,56
	10-21-*	SARGENT Signature Construction Key System (Lost Ball)	41-44,46,48,50,52,54,56
Signature Large Format Interchangeable Core (Removable Core)	**10-63-***	SARGENT Signature LFIC (removable) Core Cylinder	42, 43, 44 & 46
XC- Key System	**11-***	XC Key System (not available with other key systems, unless specified)	41-44,46,48,50,52,54,56
	11-21-*	XC- Construction Key System (Lost Ball)	41-44,46,48,50,52,54,56
XC- Large Format Interchangeable Core (Removable Core)	**11-60-***	Hardware to accept XC- Permanent LFIC (removable core), disposable plastic core provided	42, 43, 44 & 46
	11-63-*	Hardware provided with XC- LFIC (removable core) cylinder — (Includes masterkeying, grand masterkeying)	42, 43, 44 & 46
	11-64-*	Hardware provided with keyed construction core to accept XC- LFIC (removable) permanent core ordered separately	42, 43, 44 & 46
XC- Small Format Interchangeable Cores	**11-70-7P-***	Hardware to accept XC- SFIC (7-Pin) XC- permanent cores, disposable plastic core provided	43 & 46
	11-72-7P-*	Hardware to accept XC- SFIC (7-Pin keyed construction core provided) cylinder permanent core ordered separately	43 & 46
	11-73-7P-*	Hardware provided with XC- Small format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)	43 & 46
	11-65-73-7P-*	Hardware provided to accept XC- Uncombinated 7-Pin SFIC (permanent) core — (packed loose)	43 & 46
Construction Key System	**21-***	SARGENT Lost Ball Construction keying for conventional, XC and Signature Series (N/A with 63- or 73-)	–
	22-*	SARGENT Construction Split Key System for conventional cylinders (existing systems only) (N/A with 10-, 11-, 63- or 73-)	–
Old Style Removable Core	**51-***	Removable core cylinder (Old style) provided (existing systems only)	142,143,144,146
	52-*	Removable construction core (Old style) permanent core ordered separately (existing systems only)	142,143,144,146

* Options not available with 50 function lockout cylinder

+ Not available with R8200 Series

Note: Interchangeable core and removable core cylinders do not meet Security Grade 1 requirements

Cylinder Options

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

Cylinder Options:

Categories	How to Specify	Detailed Description	Cylinder Sizes Available
Large Format Interchangeable Core	**60-**	Hardware to accept SARGENT permanent LFIC (removable core), disposable plastic core provided (permanent cores ordered separately)	42, 43, 44 & 46
	63-	Hardware provided with LFIC (removable core) cylinder - (Includes masterkeying, grand masterkeying)	42, 43, 44 & 46
	64-	Hardware provided with Keyed construction core to accept LFIC (removable) permanent core (ordered separately)	42, 43, 44 & 46
Small Format Interchangeable Cores	**70-***	Hardware to accept 6- or 7-Pin SFIC permanent cores, disposable plastic core provided	43 & 46
	72-*	Hardware to accept 6- or 7-Pin SFIC (keyed construction core provided) cylinder (permanent core ordered separately)	43 & 46
	73-*	Hardware provided with 6-Pin SFIC (Includes masterkeying, grand masterkeying)	43 & 46
	65-73-*	Hardware provided to accept uncombinated 6-Pin SFIC (permanent) core — (packed loose for field keying)	43 & 46
	65-73-7P-*	Hardware provided to accept uncombinated 7-Pin SFIC (permanent) core — (packed loose for field keying)	43 & 46
	73-7P-*	Hardware provided with Small Format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)	43 & 46
Keso & Keso F1	**81-***	Hardware provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores (permanent cores ordered separately)	172-174,176
	82-	Hardware provided with SARGENT Keso security cylinder	71-74,76
	F1-82-	Hardware provided with SARGENT Keso F1 security cylinder (patented)	71-74,76
	83-*	Hardware provided with SARGENT Keso security removable core cylinder	172-174,176
	F1-83-*	Hardware provided with SARGENT Keso F1 security removable core cylinder (patented)	172-174,176
	84-*	Hardware provided with SARGENT Keso construction cores (permanent cores ordered separately)	172-174,176
Additional Security	**BR-**	Bump resistant cylinder (available with conventional & conventional XC cylinders only)	–
Less Cylinder	**LC-**	Less cylinder – SARGENT supplies standard blocking rings for 1-1/8" cylinders (for longer cylinders order collars/rings separately)	–
Schlage Keyways	**SC-*^**	Schlage C keyway cylinder, 0 bitted	#41 Only
	SE-*^	Schlage E keyway cylinder, 0 bitted	#41 Only
Note: For V-10 Cylinders and information contact ASSA			

^ Options not available with Freewheeling Trim

* Options not available with 50 function lockout cylinder

Note: When using Interchangeable Core Cylinders, the ANSI/BHMA Cylinder Grade determines the grade of the lock, even if the lock is certified ANSI/BHMA Grade 1 with a standard cylinder

Cylinder Length	SARGENT Cylinder Sizes	Keso Cylinder Sizes	Keso R/C Cylinder Sizes
1-1/8"	#41	#71	N/A
1-1/4"	#42	#72	#172
1-3/8"	#43	#73	#173
1-1/2"	#44	#74	#174
1-3/4"	#46	#76	#176
2"	#48	N/A	N/A
2-1/4"	#50	N/A	N/A
2-1/2"	#52	N/A	N/A
2-3/4"	#54	N/A	N/A
3"	#56	N/A	N/A

How To Order, Finishes, Packaging & Security Screw Chart

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

How to Order 8200, R8200 & 7800 Mortise Locks

10-	82	71	12VDC	TR	MJ	15	RHR
Options*	**Series**	**Function**	**Voltage**	**Roses/ Escutcheons**	**Trim**	**Finish**	**Hand**
For all available options see Pages 36-38	82 R82 78 Mortise Lock	Pages 21-27 for Details	12VDC 24VDC	Pages 9-14 (With R8200, specify "R" for roseless design)	Levers — Pages 7-8, 10 FW Trim — Page 15, Push/Pull Trim — Page 16-17, Knobs — Page 20	Page 41	RHR
							RH
			Must be specified for Functions 70, 71, 72 & 73				LHR
							LH

* Multiple options can be selected

Finishes

Standard Levers & Knobs	BHW Trim	BHL Trim	BHD Trim	Studio Collection Lever Trim	8200 Coastal Series™ Trim and 8200 Freewheeling Trim	7800 Push/Pull Trim	Description	ANSI/BHMA
03				03	03	03	Polished brass, clear coated	605
04				04	04	04	Satin brass, clear coated	606
09				09	09	09	Polished bronze, clear coated	611
10				10	10	10	Satin bronze, clear coated	612
10B				10B	10B	10B	Oxidized bronze, oil rubbed	613
10BE				10BE	10BE		Dark oxidized satin bronze, equivalent	(613E)
10BL				10BL	10BL		Oxidized satin, bronze, clear coated	614
14				14	14		Polished nickel, clear coated	618
15 *				15 *	15 *		Satin nickel, clear coated	619
20D				20D	20D		Statuary dark bronze, clear coated	624
26				26	26		Polished chrome	625
26D *				26D *	26D *		Satin chrome	626
32	32	32	32	32		32	Polished stainless steel	629
32D *	32D *	32D *	32D *	32D *		32D *	Satin stainless steel	630
BSP				BSP	BSP		Black suede powder coat	—
WSP				WSP	WSP		White suede powder coat	—

* MicroShield® — optional designate SG- option (Available on 15, 26D, and 32D Finishes only)
Split Finishes — specify outside finish first, then inside finish example: US26D (outside) / US04 (inside)

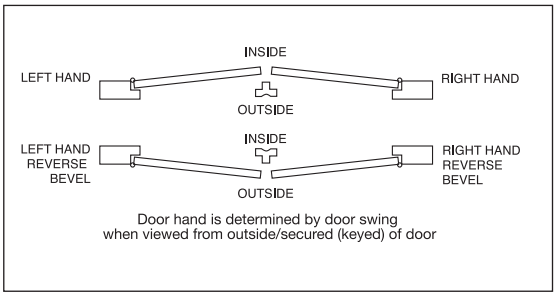
6 Lobe & Spanner Bit packs

Part Number	Descriptions
82-3855	6 Lobe Bit Pack 6 bits
82-3856	(sizes- T8, T9, T10, T15, T20, T25, T27) 9/32" Driver Spanner Bit Pack 5 bits (sizes- 6, 8, 10, 12, 14) 1/4" Driver

Packaging

8205 x LNL	approx. 6.1 lbs. (2.7kg)/box	6 boxes/case
8205 x WTL	approx. 7.2 lbs. (3.1kg)/box	6 boxes/case

Door Handing



Door hand is determined by door swing when viewed from outside/secured (keyed) of door

* Multiple options available
Wrought Box Strike optional — must order with lockset as WBS- option

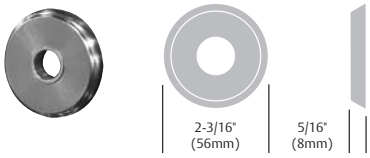
Coastal Series™ & Standard Trim

8200/R8200/7800 Mortise Locks

Coastal Series Roses & Escutcheons

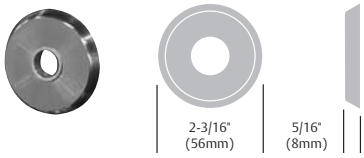
TR Traditional Rose

- Dual radii edge



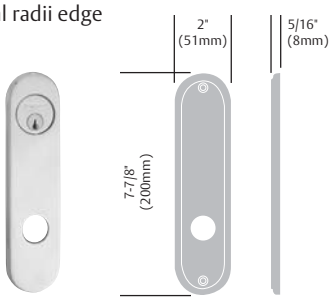
CR Contemporary Rose

- Beveled edge



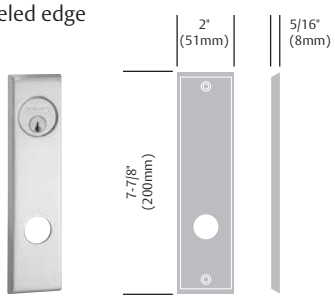
TE Traditional Escutcheon

- Dual radii edge



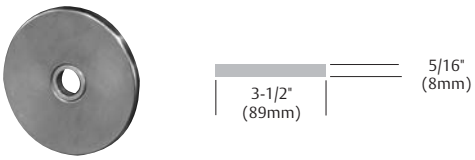
CE Contemporary Escutcheon

- Beveled edge

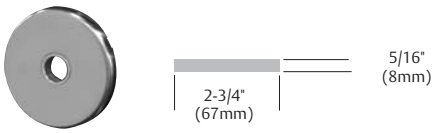


Standard Roses

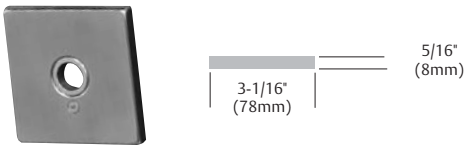
L Rose



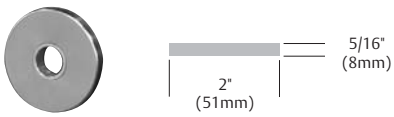
O Rose



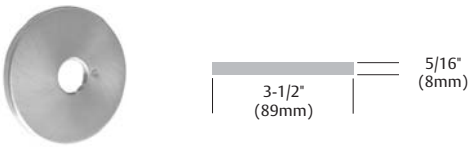
E Rose



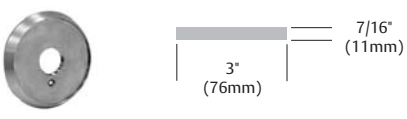
LN Rose



SL Rose



BH Rose



Coastal Series™ & Standard Levers

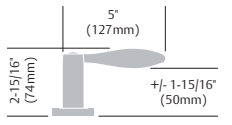
8200 Mortise Locks

SARGENT®
ASSA ABLOY

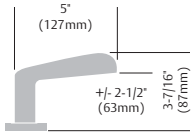
Coastal Series
(8200 & R8200 Series)

Features
- All levers meet ADA compliance for national codes
- Not available with CO and TO roses
- Levers are solid cast brass
- Finishes available – 3, 4, 9, 10, 10B, 10BE, 10BL, 14, 15, 20D, 26, 26D, BSP, WSP
- All lever height (+/- 1/16") measurements represent total distance from door face

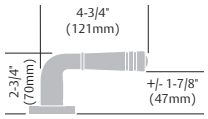
G - Gulfport™ (Handed)



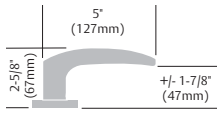
S - Sanibel™ (Handed)



R - Rockport™



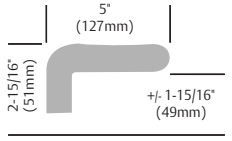
Y - Yarmouth™ (Handed)



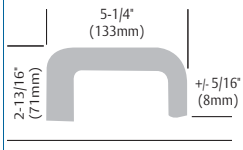
Standard Levers
(8200 Series Only)

Features
- All levers meet ADA compliance for national codes
- Solid forged or cast
- Lever designs J, L and P have lever returns within 1/2" (13mm) or less of door face and meet California State Reference Fire Code
- All lever height (+/- 1/16") measurements represent total distance from door face

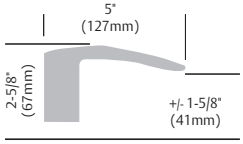
A (Handed)



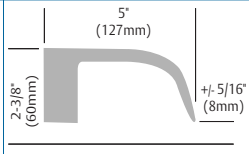
J



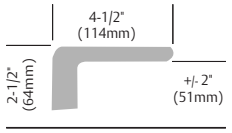
B



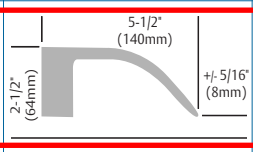
L



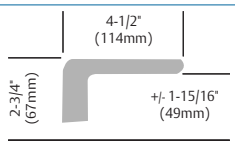
E



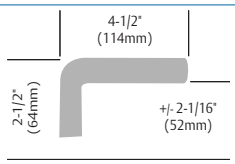
P



F



W



Electrical Functions & Monitoring Options

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

SARGENT 8200 Electromechanical Mortise locks are designed to handle single opening, stand alone applications, or can be readily integrated into sophisticated access control systems. They meet ANSI/BHMA A156.13 Grade 1 requirements, are UL listed on fire doors, and satisfy industry standards for operating temperature, shock and fire hazard.

Featuring EcoFlex® Technology*

- **Reduces energy consumption up to 96%, as certified by GreenCircle**
  - Lower operating costs
  - Assists with load reduction in optimizing energy performance credit in LEED
  - Reduces number of power supplies required
- **Field configurable to fail-safe or fail-secure**
- **Operates from 12-24VDC, offering greater flexibility in system design**
- **Innovative actuator design provides superior reliability**
  - Higher performance and reduced maintenance
  - Ability to have longer cable runs without negatively impacting lock function
  - Reduces risk of voltage drops and eliminates inductive kickback
  - Lower total cost of ownership

**Patent pending*

Electrical Requirements for electromechanical functions:

Voltage: Operates from 12-24VDC Regulated. Full wave rectification installed inside the lockbody.

Current:

- Actuator draw = .015 Amp continuous
- Maximum (2) locks per 1 Amp power supply (1/2 Amp peak current draw)

Operating Temp.: Max. 151°F (66°C), Min –31°F (-35°C)

UL and CUL listed for use on Fire Doors

Note: Repeated operation at voltage exceeding +/- 10% is not recommended

Warning:

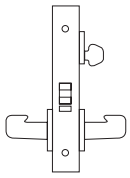
- **Do not** connect locks to a circuit sharing an additional electromagnetic device as the lock may be damaged
- Transient voltage must be suppressed at the source or before connecting with the lock
- Varistor rated at 35 volts (peak) may be used for transient voltage protection

Note: Opening the lockbody or the actuator replacement in the field by non-authorized personnel voids UL label and lock warranty

Electromechanical Functions

70 Electrical (Fail Safe)
71 Electrical (Fail Secure)

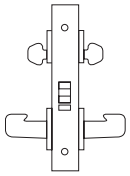
8200 & R8200



- 70 function — Power ON, locks outside lever
- 71 function — Power ON, unlocks outside lever
- Specify voltage: 12VDC or 24VDC (operates from 12-24VDC)
- Key outside retracts latchbolt
- Lever outside retracts latchbolt, except when locked
- Lever outside can only be locked electronically
- Lever inside always retracts latchbolt
- Auxiliary deadlatch

72 Electrical (Fail Safe)
✦73 Electrical (Fail Secure)

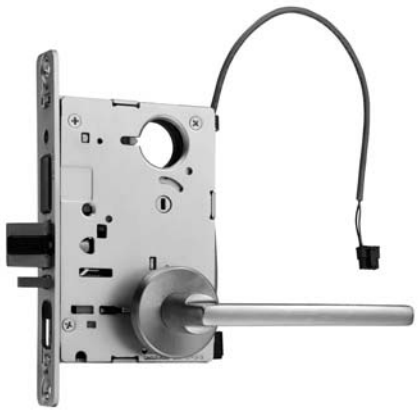
8200 & R8200



- 72 function — Power ON, locks both levers
- 73 function — Power ON, unlocks both levers
- Specify voltage: 12VDC or 24VDC (operates from 12-24VDC)
- Key on either side retracts latchbolt
- Lever from either side retracts latchbolt, except when levers are locked
- Both Levers can only be locked & unlocked electronically
- Levers can not be locked separately, only together
- Auxiliary deadlatch

Electrified Mortise Locks with Standard Monitoring Options

- Single Pole Double Throw (SPDT) type C switches
- **RX- option — Request-to-Exit or Enter Signaling Switch**
  - Two switches mounted internally in lockbody that provide independent monitoring of inside and outside lever rotation
  - Available in all functions with non rigid levers
  - Not available for the following options: 1-, 3P, 74
  - Not available for the following trims: LS or FE
- **LX- option — Latchbolt Monitor**
  - Single switch mounted within lockbody signaling latchbolt position
  - Available for all non deadbolt functions
  - Not available with DX
- **DX- option — Deadbolt Monitor**
  - Switch mounted internally in lockbody that indicates deadbolt position
  - Not available for the following options: 3P-, 74 or LX
  - Available in all deadbolt functions



✦**CAUTION**: Not recommended for use on any door used for Life Safety egress

Functions & Descriptions

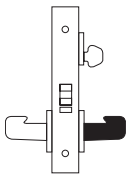
8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Single Cylinder without Deadbolt

*‡04 Storeroom or Closet

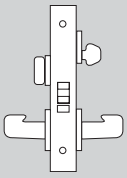
8200, R8200 & 7800



- Key outside retracts latchbolt
- Trim outside locked at all times
- Trim inside always retracts latchbolt
- Auxiliary deadlatch
- A Multi-Function 8200/R8200/7800 Lockbody
- **ANSI F07**

*05 Office or Entry

8200, R8200 & 7800



- Key outside retracts latchbolt, also locks & unlocks outside trim
- Trim inside always retracts latchbolt, trim outside remains locked
- Thumbturn inside locks & unlocks outside trim
- Auxiliary deadlatch
- A Multi-Function 8200/R8200/7800 Lockbody
- **ANSI F04**

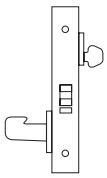
The Multi-Function Advantage with rose trim:

1. Lock will accommodate 04, 05, 15 & 37 functions without additional parts.
2. By adding an additional cylinder, lock will accommodate 38 function.
3. By adding a Trim One Side Kit, lock will accommodate 06, 13, 31 & 36 functions.

NOTE: Office/Entry Function with toggle is a 55 function.

06 Storeroom or Service

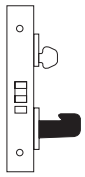
8200, R8200 & 7800



- No trim outside, cylinder only
- Key outside retracts latchbolt
- Trim inside always retracts latchbolt
- Auxiliary deadlatch
- A Multi-Function 8200/R8200/7800 Lockbody
- Same as 04 Function without trim outside

✦*31 Utility

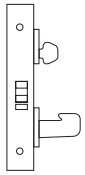
8200, R8200 & 7800



- Key outside retracts latchbolt
- Trim outside is always locked
- No inside trim or cylinder
- A Multi-Function 8200/R8200/7800 Lockbody
- Auxiliary deadlatch

*✦36 Closet

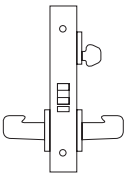
8200, R8200 & 7800



- Key locks and unlocks trim
- No inside trim or cylinder
- A Multi-Function 8200/R8200/7800 Lockbody
- Auxiliary dead latch

*‡37 Classroom

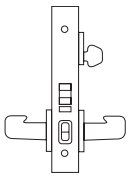
8200, R8200 & 7800



- Key outside retracts latchbolt, also locks & unlocks outside trim
- Trim inside always retracts latchbolt
- Auxiliary deadlatch
- A Multi-Function 8200/R8200/7800 Lockbody
- **ANSI F05**

55 Office or Entry

8200, R8200 & 7800



- Key outside retracts latchbolt
- Trim inside always retracts latchbolt, outside trim remains locked
- Trim outside is locked & unlocked by the toggle only
- Auxiliary deadlatch

*8200 Available with Freewheeling Trim
‡ 7800 Available with Push/Pull Trim

If shaded, knob or lever rigid at all times

✦**CAUTION**: Not recommended for use on any door used for Life Safety egress

Functions & Descriptions

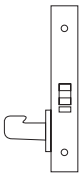
8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Non-Keyed

13 Exit Latch

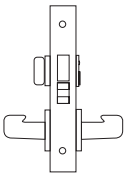
8200, R8200 & 7800



- No outside trim or cylinder
- Trim inside retracts latchbolt
- A Multi-Function 8200/R8200/7800 Lockbody
- Auxiliary deadlatch
- **ANSI F31**

*66 Privacy Bath/Bedroom

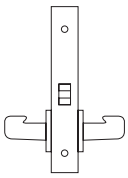
8200, R8200 & 7800



- Trim outside retracts latchbolt except when deadbolt is projected
- Trim inside retracts both latchbolt and deadbolt simultaneously, unlocking the outside trim
- Emergency Release retracts and projects deadbolt — by coin, screw driver or Emergency key (14-0057) ordered separately
- Thumbturn retracts and projects deadbolt
- **ANSI F19**

‡15 Passage or Closet

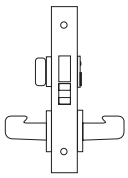
8200, R8200 & 7800



- Trim from either side retracts latchbolt at all times
- **ANSI F01**

✦68 Privacy Bath/Bedroom

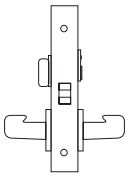
8200, R8200 & 7800



- Trim from either side retracts latchbolt at all times
- Thumbturn retracts and projects deadbolt
- Emergency release retracts and projects deadbolt — by coin, screwdriver or Emergency key (14-0057) ordered separately
- Latchbolt and deadbolt are independent of each other
- **ANSI F02**

*‡ 65 Privacy Bath/Bedroom

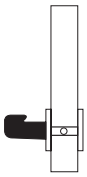
8200, R8200 & 7800



- Trim outside retracts latchbolt except when locked by thumbturn
- Trim inside retracts latchbolt and unlocks outside trim
- Emergency Release locks/unlocks trim outside- by coin, screwdriver or Emergency key (14-0057) ordered separately
- Thumbturn locks and unlocks trim outside
- Closing the door will unlock outside trim
- **ANSI F22**

93 Trim Dummy

8200, R8200 & 7800



- Trim on inside of door is always rigid
- Trim only used as door pull
- For double door applications, installed on the inactive door, use template #4298 to accept latchbolt from active door

Note: Lever is through-bolted

*8200 Available with Freewheeling Trim
‡ 7800 Available with Push/Pull Trim

If shaded, knob or lever rigid at all times

✦**CAUTION**: Not recommended for use on any door used for Life Safety egress

7800/8200 Series Mortise Lock Upgrade Kit Selector – Sectional Trim

Upgrade your 7800/8200 Series mortise lock with sectional trim to include status indicators on the inside or outside of the door. Please select one option from each of the seven categories below to generate the appropriate upgrade kit order string. (Note: each kit is supplied

Discontinued Products +

for one side of the door only. If indicators are needed on both sides of the door, you must use 2 order strings.)

1. Select Door Thickness

1-3/8"	1-3/4"	2-1/4"	2-1/2"

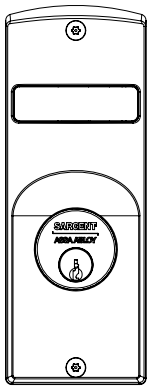
2. Select Handing

RH	LH	RHR	LHR

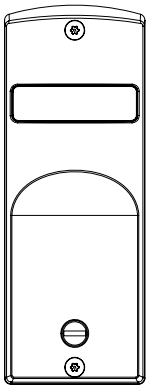
3. Select Finish

03	04	09
10	10B	10BE
14	15	20D
26	26D	BSP
	WSP	

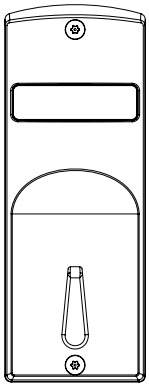
4. Select Upgrade Kit



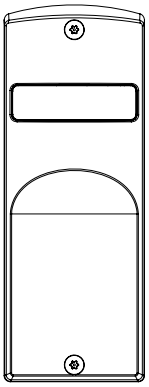
Cylinder Kit



Cointurn Kit



Thumbturn Kit



Blank/No Input Kit

5. Select Location

Inside of Door

Outside of Door

6. Select Indicator Window Display

7. Engraving?

Yes

No

Product Catalog

SARGENT
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Auxiliary Locks

ASSA ABLOY, the global leader
in door opening solutions

8200 Series Deadbolts

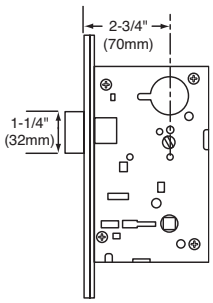
Auxiliary Locks

SARGENT
ASSA ABLOY

Specifications

For Doors	Door thickness 1-3/4" (44mm) standard (For thicker doors, consult factory)
Backset	2-3/4" only
Strike	4-7/8" (124mm), ANSI Standard A115.1. Available finishes 03, 04, 09, 10, 10BE, 10BL, 15, 20D, 32, 32D
Deadbolt	One piece hardened stainless steel deadbolt with 1" (25mm) throw
Cylinder	Brass, 6 pin. 2 keys per lock. Also available with the SARGENT Signature and Keso and Keso F1 security systems **NOTE: See 8200 Mortise Lock catalog (page 25) for details on cylinder requirements.**
Masterkeying	Can be masterkeyed. Construction key systems available
Case	12 gauge heavy duty wrought steel, zinc dichromate plated
Outside Front Plate	Brass, bronze and stainless steel. 8" (203mm) x 1-1/4" (32mm), ANSI Standard 115.1. Adjustable at any angle from flat to beveled 1/8" (3mm) in 2" (51mm)
Hand	Non-handed
Mechanical Options	Cylinder Options see page 11-12 1- For 1-3/8" thick doors; front 1-1/16" wide 23- 4-7/8" (124mm) ANSI Strike with 1-1/8" (29mm) Flat Lip 31- 2-1/4"- 2-1/2" thick doors, centered in door prep, no paneling. Consult factory for other door thicknesses available by special application. 36- 6 Lobe Torx® Security Screws 37- Spanner head security screws 74- Lock case wrapped in lead (specify hand) SG- MicroShield® antimicrobial clear powder coat (only available with 32D) WBS- Wrought Box Strike
Finishes	03, 04, 09, 10, 10B, 10BE, 10BL, 15, 20D, 26, 26D, 32, 32D, BSP, WSP For other finishes consult factory

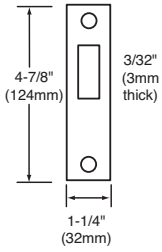
8200 Deadlock



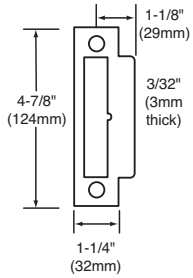
How To Order

10-28-	8230	26D
Options	Series x Function	Finish
Mechanical Options this page	8203	03, 04, 09, 10, 10B, 10BE, 10BL, 20D, 32 & 32D
	8220	
Cylinder Options page 11-12	8221	
	8222	
	8223	

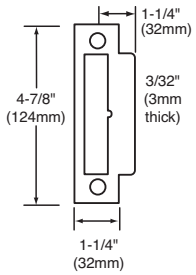
7730 Strike (Standard)



82-0229 Strike Flat Lip Alternative (23- Option)

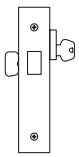


82-0109 Strike Curved Lip Alternative (Specify as 82-0109)



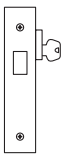
Functions

03 Classroom



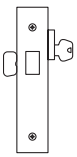
- Key outside operates deadbolt
- Thumb turn inside retracts deadbolt, but will not project it

20 Deadlock ***



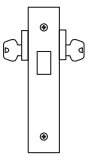
- Key outside operates deadbolt
- No inside operation
- **ANSI F18**

21 Deadlock



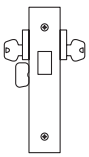
- Key outside operates deadbolt
- Thumb turn inside operates deadbolt
- **ANSI F17**

22 Deadlock ***



- Key from either side operates deadbolt
- **ANSI F16**

23 Classroom



- Key from either side operates deadbolt
- Thumb turn inside will retract deadbolt, but will not project it

***** For use only on rooms with more than one exit**

NOTE: For deadbolt function locks with levers see the 8200 Mortise Lock Catalog

Cylinder Options by Product Line

Auxiliary Locks

Cylinder Type	Option	Description	8200 & 4870 Dead Bolt	480 Dead Bolt	470 Dead Bolt	758 & 858 Padlocks	856 & 857 Padlocks	1655 Locker Lock	4141-4143 Utility & Cabinet Locks	4152, 4153, 4253 Utility Locks
Conventional Cylinder	Std	SARGENT Conventional Cylinders	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
Degree Key System	DG1-	SARGENT Degree Key System Level 1	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG1-21-	Degree Level 1 Construction Master Keying	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG1-60-	Degree Level 1 Removable Disposable Construction Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG1-63-	Degree Level 1 Removable Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG1-65-	Degree Level 1 Unassembled/Uncombined Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG2-	SARGENT Degree Key System Level 2	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG2-21-	Degree Level 2 Construction Master Keying	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG2-60-	Degree Level 2 Removable Disposable Construction Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG2-63-	Degree Level 2 Removable Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG2-64-	Degree Level 2 Removable Construction Keyed LFIC	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG2-65-	Degree Level 2 Unassembled/Uncombined Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG3-	SARGENT Degree Key System Level 3	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG3-21-	Degree Level 3 Construction Master Keying	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	DG3-60-	Degree Level 3 Removable Disposable Construction Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG3-63-	Degree Level 3 Removable Core	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	DG3-64-	Degree Level 3 Removable Construction Keyed LFIC	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
Signature Key System	10-	SARGENT Signature Key System (Not Available with other Key Systems)	Yes	Yes	Yes	Yes	N/A	Yes	N/A	N/A
	10-21-	SARGENT Signature Construction Key System (Lost Ball)	Yes	Yes	Yes	Yes	N/A	Yes	N/A	N/A
Signature: Large Format Interchangeable Core (Removable Core)	10-63-	SARGENT Signature LFIC (Removable Core) Cylinder	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
XC- Key System	11-	XC Key System (Not Available with other Key Systems, Unless specified)	Yes	Yes	Yes	Yes	N/A	Yes	N/A	N/A
	11-21-	XC- Construction Key System (Lost Ball)	Yes	Yes	Yes	Yes	N/A	Yes	Yes	N/A
XC- Large Format Interchangeable Core + (Removable Core)	11-60-	Hardware to accept XC- Permanent LFIC (Removable Core), Disposable plastic Core- provided	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	11-63-	Hardware provided with XC- LFIC (Removable Core) Cylinder - (Includes masterkeying, grand masterkeying)	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	11-64-	Hardware provided with Keyed construction core to accept XC- LFIC (Removable) Permanent Core (ordered Separately)	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
XC- Small Format Interchangeable Cores+	11-70-7P-	Hardware to accept XC- SFIC (7 pin) XC- Permanent Cores, plastic disposable core provided	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	11-72-7P-	Hardware to accept XC- SFIC (7 pin Keyed Construction Core provided) cylinder, Permanent core ordered separately	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	11-73-7P-	Hardware supplied with XC- Small Format 7 pin interchangeable core (Includes masterkeying, grand masterkeying)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	11-65-73-7P-	Hardware to accept XC- Uncombinated 7 pin SFIC (Permanent) Core - (Packed Loose)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Construction Key Systems	21-	SARGENT Lost Ball Construction Keying for Conventional, XC and Signature Series (N/A with 63-, 73-, 82-, SC- & SE-)	Yes	Yes	Yes	Yes	N/A	Yes	Yes	N/A
	22-	SARGENT Construction Split Key System for Conventional Cylinders (Existing Systems) (N/A with 10-, 11-, 63-, 73-, 82-, SC- & SE-)	Yes	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Old Style Removable Core	51-	Removable Core Cylinder (Old Style) provided (Existing systems only)	Yes	N/A	N/A	Yes	N/A	N/A	N/A	N/A
	52-	Removable Construction Core (Old Style) Permanent core ordered separately (existing systems only)	Yes	N/A	N/A	Yes	N/A	N/A	N/A	N/A

NOTE: For V-10 Cylinder and information, contact ASSA
NOTE: When tying into existing key systems contact Key Records for compatibility
+ For use in SARGENT hardware ordered to accept XC- option

Cylinder Options by Product Line

Auxiliary Locks

Cylinder Type	Option	Description	8200 & 4870 Deadbolt	480 Dead Bolt	470 Dead Bolt	758 & 858 Padlocks	856 & 857 Padlocks	1655 Locker Lock	4141-4143 Utility & Cabinet Locks	4152, 4153, 4253 Utility Locks
Large Format Interchangeable Core (Removable Core)	60-	Hardware to accept Permanent LFIC (Removable Core), Disposable plastic Core provided (Permanent Cores Ordered Separately)	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	63-	6 pin LFIC permanent core provided	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
	64-	Hardware supplied with Keyed LFIC construction core to accept Permanent LFIC Core (ordered Separately)	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A
Small Format Interchangeable Cores	70-	Hardware to accept 6 or 7 Pin SFIC Permanent Cores (ordered separately), plastic disposable core provided	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	72-	Hardware to accept 6 or 7 Pin SFIC supplied with Keyed Construction Core. (Permanent Core Ordered separately)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	73-	Hardware supplied with 6 pin SFIC (Includes masterkeying, grand masterkeying)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	65-73-	Hardware provided to accept Uncombinated 6 pin SFIC (Permanent) Core - (Packed Loose for field keying)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	65-73-7P-	Hardware provided to accept Uncombinated 7 pin SFIC (Permanent) Core - (Packed Loose for field keying)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
	73-7P-	Hardware supplied with Small Format 7 Pin Interchangeable Core (Includes masterkeying, grand masterkeying)	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Keso F1 & Keso	81-	Hardware provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores. (Permanent Cores Ordered Separately)	Yes	N/A	N/A	N/A	N/A	N/A	N/A	Std.
	82-	Hardware provided with standard Keso Security Cylinder	Yes	N/A	N/A	N/A	Std	N/A	N/A	N/A
	F1-82-	Hardware provided with standard Keso F1 Security Cylinder (Patented)	Yes	N/A	N/A	N/A	Specify F1-	N/A	N/A	Specify F1-
	83-	Hardware supplied with SARGENT Keso Security Removable Core cylinder	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	F1-83-	Hardware supplied with SARGENT Keso F1 Security Removable Core cylinder (Patented)	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	84-	Hardware provided with SARGENT Keso Construction Cores (Permanent Removable Cores ordered separately)	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bump Resistant	BR-	Bump Resistant Cylinder (Available with Conventional & Conventional XC Cylinders Only)	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
Less Cylinder	LC-	Less Cylinder	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Schlage Keyways	SC-	Schlage C keyway cylinder, 0 bitted	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A
	SE-	Schlage E keyway cylinder, 0 bitted	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A

NOTE: For V-10 Cylinder and information, contact ASSA
NOTE: When tying into existing key systems contact Key Records for compatibility
+ For use in SARGENT hardware ordered to accept XC- option

Product Catalog

SARGENT
ASSA ABLOY

7800/8200 Series
Mortise Locks

ASSA ABLOY, the global leader
in door opening solutions

Specifications & Certifications

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

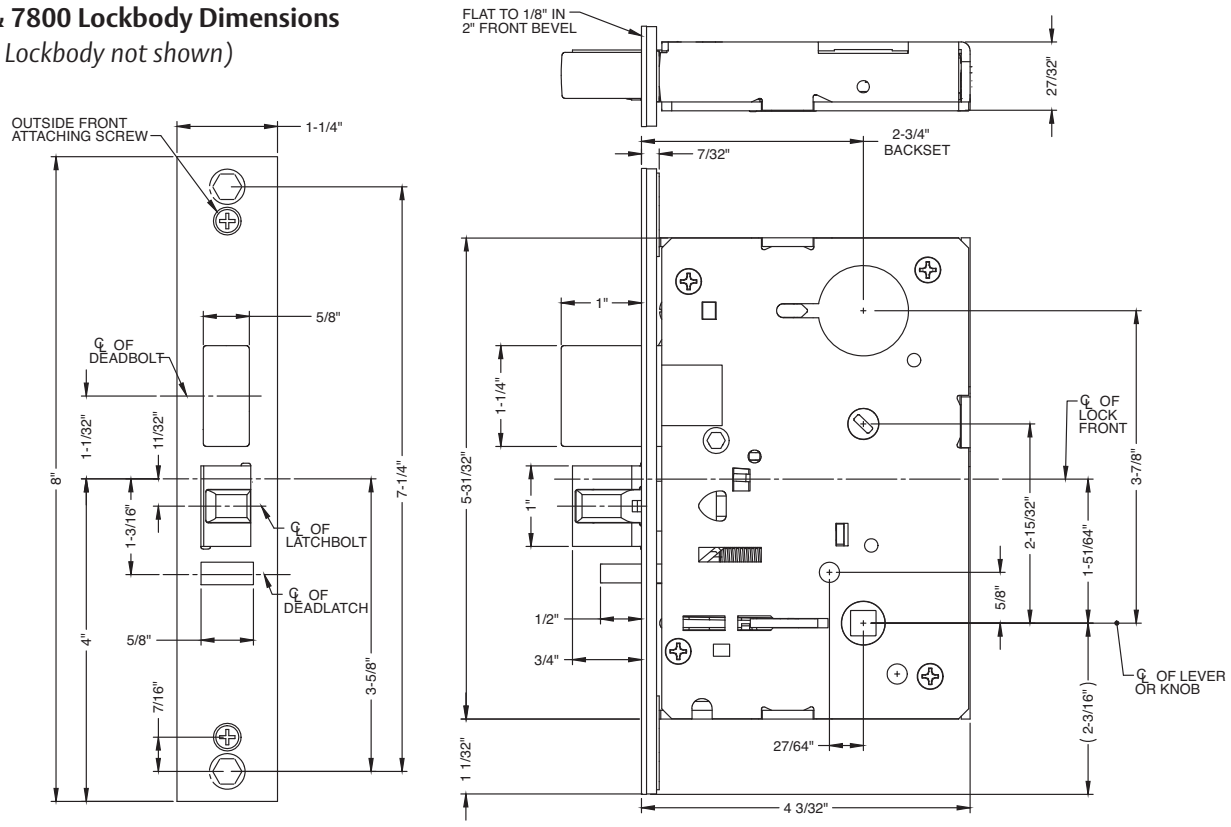
Certification Compliance

ANSI/BHMA	Certified to ANSI/BHMA A156.13 Series 1000 Operational Grade 1 and Security Grade 1 with all standard trims. ANSI/ASTM F476-84 Grade 40 with concealed mortise cylinder. **Note:** LFIC (Removable) Cylinders and SFIC Cylinders do not meet Security Grade 1 requirements.
ADA	Meets A117.1 Accessibility Code. Meets BOMA International 4.13.8 Complies with American Disability Act; Consult local authorities
UL-cUL	UL and cUL Listed to US and Canadian safety standards for A label 4 x 10 single and 8 x 10 double (3 hour fire door) and lesser class doors, stamped letter F and UL symbol on armored front indicate listing
Positive Pressure	Meets ANSI/UL 10C, Positive Pressure Fire Test of Door Assemblies
California	California State Reference Code (Formerly Title 19, California State Fire Marshal Standard) All levers with returns comply; levers return to within 1/2" (13mm) of door face
Tornado and Hurricane Codes	See page 4

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

8200 & 7800 Lockbody Dimensions

(R8200 Lockbody not shown)



Note: R8200 and 8200 lockbodies are dimensionally the same except for the through-bolt locations

Explanation of the 8200/7800 Lockbody types:

Lockbody Type[1]	Trim Available x Lockbody type	Standard 8200 Door Prep	Through Bolted Trim	Multi-function lockbody available	How to order lockbody only
8200	Lever x Rose/Escutcheon	Yes	Yes	Yes	82 x Function x Finish[3]
7800	Knob x Rose/Escutcheon	Yes	Yes	Yes	78 x Function x Finish[3]
R8200	Simpli™ roseless trim	No	Yes[2]	Yes	R82 x Function x Finish[3]
8200 for ALP	ALP Push/Pull Trim	Yes	Yes	Yes	Six Digit Part # determined by function*
7800 PT	PT Push/Pull Trim	Yes	Yes	Yes	Six Digit Part # determined by function*

[1] Lockbodies can only be used with the specified trim
[2] Through Bolt locations are different from standard trim, special door prep required
[3] **Note:** Cylinder and trim not included. Outside front, strike and screw pack are included
* See Price book; **Note:** Outside Fronts, Strikes, Cylinders and Trim are NOT included

Windstorm Certifications

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Windstorm Certifications: Florida Building Codes & UL Listings

SARGENT Manufacturing's products meet building codes that require hurricane, windstorm and FEMA certifications, including some of the most stringent building codes as specified in the Florida Building Code, Miami Dade Code and the International Building Code. Listed below are certifications and standards met by the 7800/8200 lock.

Florida Building Code: FL2998
UL Certification Directory: ZHEM.R21744 – Latching Hardware

ANSI/SDI-BHMA A250.13	"Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies"
ANSI/ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
(TAS) 201	"Impact Test Procedures"*
(TAS) 202	"Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure"
(TAS) 203	"Criteria for Testing Products Subject to Cyclic Wind Pressure Loading"*

* Published in the "Florida Building Code"

UL Certification Directory: ZHLL.R21744 – Products for Use in Windstorm-rated Assemblies

Certifications to meet assembly requirements are done in conjunction with doors from ASSA ABLOY Group companies CECO DOOR and CURRIES.

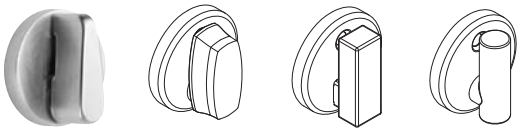
ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
AAMA/WDMA/CSA 101/I.S.2/A440	"Standard/Specification for Windows, Doors, and Unit Skylights"

Thumbturn Designs

8200/R8200/7800 Mortise Locks

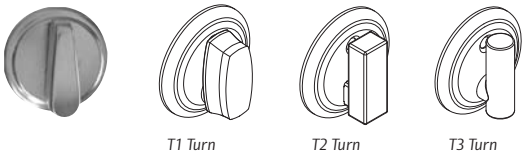
SARGENT
ASSA ABLOY

130KB Round Backplate
(Shown with Standard Turn)



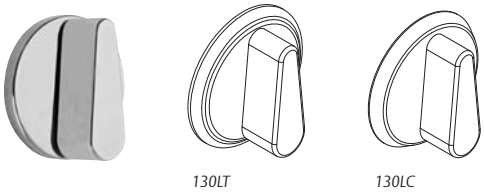
- Round backplate supplied standard with L, O, LN roses and R8200 roseless trim
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-1/2" (38mm) round brass or stainless steel plate
- Meets ADA Requirements

130KT Traditional Backplate
(Shown with Standard Turn)



- Dual radii edge backplate supplied standard with TO and TR roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-3/4" (44mm) round brass plate
- Meets ADA Requirements

130LB Large Round Backplate
(Shown with Large ADA Turn)

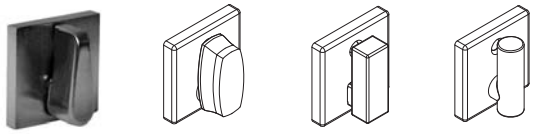


- Available with R8200 & 8200 with sectional trim
- 40% larger than standard thumbturn
- Specify LB as an option for ADA turn
- 2" (51mm) round brass, zinc, or stainless steel plate & turn
- 130LT - Traditional backplate, 130LC — Contemporary backplate
- Meets ADA Requirements

126 T-Turn
(7892 function only)

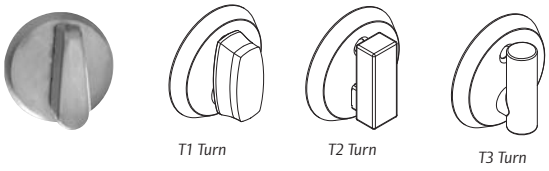
- 2-3/16" (56mm) round stainless steel backplate
- 2-3/8" (61mm) tall thumbturn
- Available in brass or bronze finishes only
- Surface mounted with three screws
- Order as "SST" trim with 7892 function

130KA Square Backplate
(Shown with Standard Turn)



- Square backplate supplied standard with E, E2, E3 or E4 roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-1/2" (38mm) round brass or stainless steel plate
- Meets ADA Requirements

130KC Contemporary Backplate
(Shown with Standard Turn)



- Beveled edge backplate supplied standard with CO and CR roses
- Standard turn automatically supplied with sectional trim for R8200 & 8200 locks
- Specify T1, T2 or T3 as an option for decorative turns
- 1-3/4" (44mm) round brass or stainless steel plate
- Meets ADA Requirements

130KBHA Turn for use with 8200 Mortise BHW, ALP, BHL and BHD Trim

- 3-3/4" x 2-1/2" rectangular shape
- Stainless steel housing
- Meets ADA and OMH Requirements

130W Round Backplate
(Shown with Standard Turn)

- Used with 7800 with sectional trim
- 1-1/2" (38mm) round brass or stainless steel plate

Emergency Releases & Accessories

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Emergency Releases

184KB Emergency Release (used with R8200 & 8200 with sectional trim)

- 1-1/2" (38mm) round brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

Studio Collection Emergency Release

- 184KC Emergency Release Contemporary
- 184KT Emergency Release – Traditional

184W Emergency Release (used with 7800 with sectional trim)

- 1-1/2" (38mm) round brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

184KA Emergency Release (used with E rose)

- 1-1/2" (38mm) square brass, bronze or stainless steel plate
- For 65, 66 and 68 functions only

Emergency Key 14-0057

- Carbon steel
- For 65, 66 and 68 functions only
- Must be ordered separately

184KBHA Emergency Release (used with BHW, ALP, BHL and BHD trim)

- 3-3/4" x 2-1/2" rectangular shape
- Stainless steel housing
- Meets ADA and OMH Requirements

Accessories

130KBCVR Cap

- Thumbturn plate
- Covers hole in door when thumb turn is no longer needed

82-4023 Cap

- 2" round
- Covers hole for levers and roses

Door Thickness	Part Number
1-3/8"	82-4022
1-3/4"	82-4023
2"	82-4024
2-1/4"	82-4025

Trim One Side Kit

Refer to page 42 for a complete list of kits

Indicators and Escutcheon Engraving

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

Sectional Trim - Indicators

49- Option Visual Status Indicator for Non Secure Applications

- Designed to work with Classroom security functions
- Red/White indicator plate standard
- Mounts on inside of door
- Functions and Roses available:
  – 30, 36 & 37 Functions with 7800, 8200 and R8200 locks, CR, L, LN, TR, E & O Roses
  – 26, 29, 38, 39, 40 and 41 Functions with 7800, 8200, and R8200 locks & LN Roses Only
- As retrofit, order 185C x finish

Inside Only

185C

49- Option Occupancy Indicator with Emergency Release

- Ideal for restrooms or conference rooms where easy determination of use needs to be made
- OCC/VAC indicator plate standard
- Mounts on outside of door
- Emergency coin operated release standard
- Functions and Roses available:
  – 65, 66, 68 Functions with 7800, 8200, and R8200 locks, CR, E, L, LN, O & TR Roses
- As retrofit, order 185P x finish

185P

50- Option Secured Indicator Rose

- Non-handed with lever and mounting posts field reversible
- VAC/OCC indicator plate standard
- Mounts on outside of door
- Available for the following functions: 24, 25, 26, 28, 29, 30, 36, 37, 38, 39, 40, 41, 43, 45, 50, 51, 52, 57, 58, 67 - with Rose Trim only
- Patent pending design
- Not available with Roseless trim (R8200)
- For retrofit, order 185S x suffix x finish:

Suffix	Door Thickness
-1	1-3/8" (35mm)
-2	1-3/4" (44mm)
-3	2" (51mm)
-4	2-1/4" (57mm)

Note: For 49- and 50- Options, key will not retract latch when used with 37 and 38 functions

Escutcheon Trim - Indicators

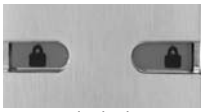
- Red/white plate with locked/unlocked icons
- Available with LE1/KE1 Escutcheons only
- Available finishes: 03, 04, 09, 10, 10B, 10BE, 10BL, 14, 15, 20D, 26, 26D, 32, 32D, BSP, WSP
- Available with MicroShield®
- Windows allow 180° view
- See chart for function availability

Options:

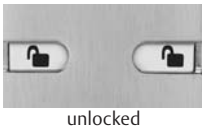
VNA - Indicator located on outside of door

VNB - Indicator located on inside of door

VNC - Indicator located on inside and outside of door



locked



unlocked

Escutcheon Trim - Engraving

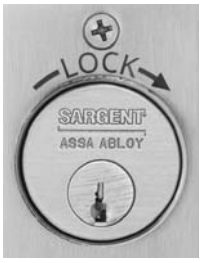
- Laser engraving with "LOCK" and directional arrow
- Available with LE1/KE1 Escutcheons only
- Available finishes: 03, 04, 14, 15, 26, 26D, 32, 32D
- Available with MicroShield®
- Door handing must be specified
- See chart for function availability

Options:

EMA - Engraving located on outside of door

EMB - Engraving located on inside of door

EMC - Engraving located on inside and outside of door



Note: If indicators and engraving are ordered together, finish offering is limited to 03, 04, 14, 15, 26, 26D, 32, 32D

		Function																									
		Single Cylinder w/o Deadbolt							Single Cylinder w/ Deadbolt									Double Cylinder w/o Deadbolt	Double Cylinder w/ Deadbolt							Deadbolt Only		
Option	**Description**	**05**	**36**	**37**	**56**	**57**	**58**	**67**	**24**	**25**	**28**	**30**	**43**	**45**	**47**	**50**	**51**	**38**	**26**	**29**	**39**	**40**	**41**	**46**	**52**	**20**	**21**	**22**
VNA	Outside Indicator	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
VNB	Inside Indicator			X														X	X	X	X	X	X	X	X			X
VNC	Indicator Both Sides			X														X	X	X	X	X	X	X	X			X
EMA	Outside Engraving	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EMB	Inside Engraving																	X*	X	X	X	X	X	X	X			X
EMC	Engraving Both Sides																	X	X	X	X	X	X	X	X			X

* Provided as standard. Inside engraving option (EMB) is not required when ordering this function. Handing must be specified.

Cylinders

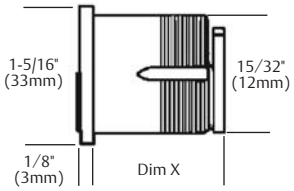
8200/R8200/7800 Mortise Locks

Cylinder Lengths (Dim X)

Cylinder No.	41	42	43	44	46	48	50	52	54	56
Dim X Length Under Cylinder Head	1-1/8" (29mm)	1-1/4" (32mm)	1-3/8" (35mm)	1-1/2" (38mm)	1-3/4" (44mm)	2" (51mm)	2-1/4" (57mm)	2-1/2" (64mm)	2-3/4" (70mm)	3" (76mm)

40 Series Type Cylinder

- Cylinder body: Solid brass
- Cap: Brass, bronze or stainless steel
- All functions take a Standard Cam Functions
- Standard Cam 13-0664
- 16 & 92 Inside Cam -105
- 50 Hotel Cam -115 supplied standard with all Hotel Function Cylinders



7850/8250 Function Hotel Cylinder

- When door is locked by deadbolt, only emergency key is able to unlock
- Must request emergency key separately (14-0036 x keying info)
- Supplied with Cam suffix -115 for Hotel Functions

10- Option Signature Series

- The protected system offers the building owner full control over duplication of keys. Highly pick-resistant cylinders
- 10-63- Option — Signature cylinder with Large Format Interchangeable Cores

F1-82- and 82- Option KESO

- The system offers the building owner full control over duplication of keys
- Highly pick-resistant cylinders
- Expanded levels of masterkeying
- F1-83- & 83- Option — Keso removable core
- 84- Option — Keso construction core cylinder

78- Option Exposed Barrel

- Standard for use only with SARGENT Escutcheon Trims KE3, KE4, LE3, LE4
- Available 6-Pin standard or 7-Pin optional
- NOT available with 50-, 60-, 70- or other specialty or higher security options
- See function table for cam required
- Not available in 50 function
- Plug finishes: 4, 15 (similar to 26 finish)

11- Option XC Key System

- Patented system works with existing SARGENT keyway adding increased security
- 11- XC standard cylinder
- 11-63- Large format interchangeable core
- 11-73- Small format interchangeable core

124 Series Mortise Cylinder Turn Lever

- Turn lever: Brass, bronze or aluminum
- Cap: Brass, bronze or stainless steel
- Must be ordered separately

DG1, DG2, DG3 - Degree Series

- Utility patented, bump resistant and requires the use of a patented key
- All three locking mechanisms within the same system to be operated with just one key
- See Degree Key System Catalog for available options

For complete cylinder information, see Cylinders & Components, Degree, Signature, Keso, Keso F1 or XC catalogs.

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51- Option Old Style Removable Core

- Available for **existing systems only** Permanent Removable Cores
- Control key used to remove core, must request control key separately

60- or 70- Option Plastic Construction Core

- For doors that do not require key locking during the construction period
- Operate with coin or flat screw driver
- For use with LFIC (removable) (60- Option) or SFIC (70- Option) core

63- Option Large Format Interchangeable (Removable) Core

- Allows immediate removal of the core. Virtually unlimited key changes
- Available 10-63-, 11-60-, 11-63- & 11-64-
- For disposable core, see 60- Option
- 64- Option- LFIC 6-Pin construction core
- Control key used to remove core, must request control key separately

7300B Interchangeable Core

- Small Format Interchangeable Core
- SARGENT Interchangeable Core cylinders and MasterKey Systems are available for increased security through quick change of keying. It is unnecessary to remove a cylinder
- SARGENT 7300B Interchangeable Cores are available in SARGENT 4A and 4B keyways, as well as the following standard competitor keyways: A, B, C, D, E, F, G, H, J, K, L, M
- For disposable core, see 70- Option
- 65-73 Option — 6-Pin Small Format Interchangeable Cores-uncombinated
- 65-73-7P Option — 7-Pin Small Format Interchangeable Cores-uncombinated
- 70- Option — Small Format Interchangeable disposable core
- 72- Option — Small Format Interchangeable construction core
- 11-72- Construction core provided for use with 11-7300 cylinder housing

  11-70- temporary plastic core prepared to accept 11-7300 core
- 73- Option — 6-Pin Small Format Interchangeable core, SARGENT 4A, 4B keyways
- 73-7P Option — 7-Pin Small Format Interchangeable core, SARGENT 4A, 4B keyways
- Control key used to remove core (provided separately)

1SB Cylinder Collar

- Standard for 7800 BHD, 8200 BHL & BHW mortise locks
- Stainless steel
- 1-29/32" diameter
- Finishes: 32, 32D
- Available in 4 sizes. See page 36 for specifics on collar sizes and measurements

21- Option Lost Ball Construction System

- The SARGENT construction keying system protects the building owner by providing temporary masterkeying during the construction period

1KB Rosette with 8200 & R8200 sectional trim

- Used with mortise cylinders and No. 90 blocking rings when cylinders project from door
- Furnished standard with L, O, LN, CO, CR, TO and TR roses
- Brass, bronze or stainless steel
- 1-1/2" (38mm) diameter, includes compression spring
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP
- Projection from door:

1KB-1	5/16" (8mm) — Standard
1KB-2	7/16" (11mm)
1KB-3	9/16" (14mm)

IKA Rosette with 8200 sectional trim

- Used with mortise cylinders
- Furnished standard with the E, E2, E3 and E4 roses
- Brass, bronze or stainless steel
- 1-1/2" (38mm) Square, includes compression spring
- Projection from door:

1KA-1	5/16" (8mm) — Standard
1KA-2	7/16" (11mm)
1KA-3	9/16" (14mm)
1KA-4	11/16" (16mm)

- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

No. 97 Rosette

- Standard for cylinders ordered separately from hardware
- Standard for 7800 knob mortise & 4870 deadbolt
- Brass, bronze or stainless steel
- 1-11/16" diameter (43mm), 9/32" (7mm) projection, includes compression spring
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 32, 32D, BSP, WSP

No. 90 Blocking Ring

- Used with 1KB rosettes as spacer when mortise cylinder projects from face of door
- Brass, bronze or stainless steel
- Finishes: 3, 4, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

1KB-5 Cylinder Retaining Cap

- Required for double cylinder functions on KS and LS Escutcheon *only*
- Steel or stainless steel
- 1-15/32" (37mm) diameter
- 9/16" (14mm) projection
- Finishes: 3, 4, 9, 10, 10B, 10BE, 10BL, 20D, 26, 26D, 32, 32D, BSP, WSP

Cylinders Requirements & Cams

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Single Cylinder

Sectional Trim (CO, CR, L, LN, O, PT, SL, SN, TO, TR)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-2	1KB-1	1KB-1	1KB-1
42	1KB-3	1KB-2	1KB-2	1KB-1
43	1KB-4	1KB-3	1KB-3	1KB-3

Sectional Trim (E, E2, E3, E4)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KA-2	1KA-1	1KA-1	1KA-1
42	1KA-3	1KA-2	1KA-2	1KA-1
43	1KA-4	1KA-3	1KA-3	1KA-3

Escutcheon Trim (CE, KE1, KE2, KW1, LE1, LE2, LW1, TE)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-1	Cylinder Only	Cylinder Only	Cylinder Only
42	1KB-2	1KB-1	Cylinder Only	Cylinder Only
43	1KB-3	1KB-1	1KB-1	Cylinder Only

Escutcheon Trim (WT)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	97	Cylinder Only	Cylinder Only	Cylinder Only
42	1SB-2	97	Cylinder Only	Cylinder Only
43	1SB-3	97	97	Cylinder Only

Specialty Hardware (BHW, BHL, BHD, ALP)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-2	1SB-1	1SB-1	1SB-1
42	1SB-3	1SB-2	1SB-2	1SB-1
43	1SB-4	1SB-3	1SB-3	1SB-3

Double Cylinder

Sectional Trim (CO, CR, L, LN, O, PT, SL, SN, TO, TR)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-3	1KB-2	1KB-1	1KB-1
42	1KB-4	1KB-3	1KB-2	1KB-1
43	97-0352	1KB-4	1KB-3	1KB-2

Sectional Trim (E, E2, E3, E4)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KA-3	1KA-2	1KA-1	1KA-1
42	1KA-4	1KA-3	1KA-2	1KA-1
43		1KA-4	1KA-3	1KA-2

Escutcheon Trim (CE, KE1, KE2, KW1, LE1, LE2, LW1, TE)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1KB-2	90 1/8	Cylinder Only	Cylinder Only
42	1KB-3	1KB-2	1KB-1	Cylinder Only
43	1KB-4	1KB-3	1KB-2	90 1/8

Escutcheon Trim (WT)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-2	97	Cylinder Only	Cylinder Only
42	1SB-3	1SB-2	97	Cylinder Only
43	1SB-4	1SB-2	1SB-2	97

Specialty Hardware (BHW, BHL, BHD, ALP)

Cylinder Size	Door Thickness			
	1-3/8"	1-3/4"	2"	2-1/4"
41	1SB-3	1SB-2	1SB-1	1SB-1
42	1SB-4	1SB-3	1SB-2	1SB-1
43	1SB-4	1SB-4	1SB-3	1SB-2

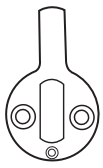
Cylinder Cams For Mortise Locks

SARGENT Conventional Cylinders

- Standard

Std Cam (13-0664) for all functions except for 50 and the Inside cam for 16 & 92 function locks

-105 Cam (13-0665) 16 & 92 Function Inside Cylinder Cam



-115 Cam (13-2045) 50 Function Hotel Cam, supplied with 50 function cylinders

See Cylinder catalogs for additional information

SARGENT Large Format Interchangeable Core Cylinders

- 6300 Cams are factory installed and are not removable
- 6300 Cams are not sold separately
- Specify required Cam as a suffix: 63-44-105 cam
- For Standard Cam: no suffix is required

Std 6300 Cam for all functions except for 50 and the Inside cam for 16 & 92 function locks

-105 Cam for 6300 Series 16 & 92 function I/S Cylinder

-115 Cam for 6300 Series 50 (Hotel) function, supplied with 50 function cylinders

Mechanical Options

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Mechanical Options:

Available mechanical options by lock type

Categories	How to Specify	Detailed Description	8200	R8200	7800
1-3/8" Door	1-	1-1/16" (27mm) wide front for 1-3/8" (35mm) doors (not available with RX-Option) (1- for 93 + 94 function is a special order)	X	-	X
Add Strength	3-	Stainless steel hubs with in the mortise lock	X	-	
Strike Option	23-	4-7/8" (124mm) ANSI flat lip strike	X	X	X
	OBS-	Open back strike	X	X	X
	WBS-	Wrought box strike	X	X	X
Thick Doors	31-	For doors 1-7/8" (48mm) to 2-1/4" (57mm) thick — see cylinder options for limitations on door thickness. When ordering the following information is required: Location of lock within the door, door thickness -IF PANELED -must specify panel thickness & panel location (inside or outside of the door) For doors thicker than 2-1/4" — consult factory.	X	X	X
Security Fasteners	36-	6 Lobe head security screws (Torx® type)	X	-	X
	37-	Spanner head security screw (not available with Studio levers)	X	-	X
Visual Indicators	49-	Visual Status Indicator or Occupancy indicator with emergency release (not available with escutcheon trim; see page 16 for details)	X	X	X
	50-	Secured indicator rose (available with rose trim only; see page 16)	X	-	X
	EMA	Engraving, Outside (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	EMB	Engraving, Inside (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	EMC	Engraving, Both Sides (Engraved with "LOCK" and directional arrow. Available with escutcheon trim LE1/KE1 only)	X	-	X
	VNA	Visual Status Indicator, Outside (Escutcheon trim LE1/KE1 only)	X	-	X
	VNB	Visual Status Indicator, Inside (Escutcheon trim LE1/KE1 only)	X	-	X
	VNC	Visual Status Indicator, Both Sides (Escutcheon trim LE1/KE1 only)	X	-	X
Electrical Options	DX-	Deadbolt monitoring — Monitor deadbolt position (not available with LX-)	X	X	X
	LX-	Latchbolt monitor — Monitors latchbolt position (not available with deadbolt functions)	X	X	X
	RX-**	Request to Exit — Monitors each lever independently (not available with LB-option)	X	X	X
	TL-	SARGuide illuminated inside WT trim with the word EXIT illuminated (4-1/2" pocket depth required)	X	-	-
Lever/Knob Combination	68-	8200 Lock furnished w/lever handle outside x knob inside (not available with the AV-Option or FE Trim)	X	-	-
	69-	8200 Lock furnished w/lever handle inside x knob outside (not available with the AV-Option or FE Trim)	X	-	-
Lead Lining	74-**	Lead lining or wrapping available with sectional trim only (not available with DX-or LX- Options)	X	-	X
Tactile Warnings	75-	Tactile Warning — Milled levers or knurled knobs. Inside trim only (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	76-	Tactile Warning — Milled levers or knurled knobs. Outside trim only (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	77-	Tactile Warning — Milled levers or knurled knobs. Inside & outside trim (not available with Studio & Coastal levers, the A lever & K, N & D knobs)	X	-	X
	85-	Tactile Warning — Abrasive coating inside trim only (not available with D knobs)	X	X	X
	86-	Tactile Warning — Abrasive coating outside trim only (not available with D knobs)	X	X	X
	87-	Tactile Warning — Abrasive coating inside & outside trim (not available with D knobs)	X	X	X
Anti-Vandal Trim	AV-	Anti-Vandal pull trim (not available with LS & FE trim and Options 1-, 31-, 49-, 50-, 68-, 69-, 76-, 77-, 86-, 87-, DX-or SG-)	X	-	X
Finish Protection	CPC-	Clear Powder Coat (available for 32 & 32D finishes)	X	X	X
	SG-*	MicroShield® antimicrobial clear powder coat	X	X	X
Thumbturns (See page 14)	LB-	ADA Extra large thumbturn; backplate matches rose design chosen	X	X	X
	T1-	Decorative thumbturn; backplate matches rose design chosen	X	X	-
	T2-	Decorative square thumbturn; backplate matches rose design chosen	X	X	-
	T3-	Decorative cylinder thumbturn; backplate matches rose design chosen	X	X	-

* Available on 15, 26D, and 32D Finishes only

** Not available in combination

Cylinder Options

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Cylinder Options:

Categories	How to Specify	Detailed Description	Cylinder Sizes Available
Conventional Cylinder		SARGENT Conventional Cylinders supplied standard	41-44,46,48,50,52,54,56
Degree Key System	**DG1-**	SARGENT Degree Key System Level 1 (bump resistant with patented keys)	41-44, 46
	DG1-21-*	Degree Level 1 Construction Master Keying	41-44, 46
	DG1-60-	Degree Level 1 Removable Disposable Construction Core	41-44, 46
	DG1-63-	Degree Level 1 Removable Core	41-44, 46
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC	41-44, 46
	DG1-65-*	Degree Level 1 Unassembled/Uncombined Core	41-44, 46
	DG1-78-*	Degree Level 1 Exposed Plug (for use with LE3/LE4 escutcheons only)	41-43
	DG2-*+	SARGENT Degree Key System Level 2 (geographically exclusive; bump and pick resistant)	41-44, 46
	DG2-21-*	Degree Level 2 Construction Master Keying	41-44, 46
	DG2-60-*	Degree Level 2 Removable Disposable Construction Core	41-44, 46
	DG2-63-*	Degree Level 2 Removable Core	41-44, 46
	DG2-64-*	Degree Level 2 Removable Construction Keyed LFIC	41-44, 46
	DG2-65-*	Degree Level 2 Unassembled/Uncombined Core	41-44, 46
	DG3-*+	SARGENT Degree Key System Level 3 (geographically exclusive; UL437 certified; bump and pick resistant)	41-44, 46
	DG3-21-*	Degree Level 3 Construction Master Keying	41-44, 46
	DG3-60-*	Degree Level 3 Removable Disposable Construction Core	41-44, 46
	DG3-63-*	Degree Level 3 Removable Core	41-44, 46
	DG3-64-*	Degree Level 3 Removable Construction Keyed LFIC	41-44, 46
Signature Key System	**10-***	SARGENT Signature Key System (not available with other key systems)	41-44,46,48,50,52,54,56
	10-21-*	SARGENT Signature Construction Key System (Lost Ball)	41-44,46,48,50,52,54,56
Signature Large Format Interchangeable Core (Removable Core)	**10-63-***	SARGENT Signature LFIC (removable) Core Cylinder	42, 43, 44 & 46
XC- Key System	**11-***	XC Key System (not available with other key systems, unless specified)	41-44,46,48,50,52,54,56
	11-21-*	XC- Construction Key System (Lost Ball)	41-44,46,48,50,52,54,56
XC- Large Format Interchangeable Core (Removable Core)	**11-60-***	Hardware to accept XC- Permanent LFIC (removable core), disposable plastic core provided	42, 43, 44 & 46
	11-63-*	Hardware provided with XC- LFIC (removable core) cylinder — (Includes masterkeying, grand masterkeying)	42, 43, 44 & 46
	11-64-*	Hardware provided with keyed construction core to accept XC- LFIC (removable) permanent core ordered separately	42, 43, 44 & 46
XC- Small Format Interchangeable Cores	**11-70-7P-***	Hardware to accept XC- SFIC (7-Pin) XC- permanent cores, disposable plastic core provided	43 & 46
	11-72-7P-*	Hardware to accept XC- SFIC (7-Pin keyed construction core provided) cylinder permanent core ordered separately	43 & 46
	11-73-7P-*	Hardware provided with XC- Small format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)	43 & 46
	11-65-73-7P-*	Hardware provided to accept XC- Uncombinated 7-Pin SFIC (permanent) core — (packed loose)	43 & 46
Construction Key System	**21-***	SARGENT Lost Ball Construction keying for conventional, XC and Signature Series (N/A with 63- or 73-)	–
	22-*	SARGENT Construction Split Key System for conventional cylinders (existing systems only) (N/A with 10-, 11-, 63- or 73-)	–
Old Style Removable Core	**51-***	Removable core cylinder (Old style) provided (existing systems only)	142,143,144,146
	52-*	Removable construction core (Old style) permanent core ordered separately (existing systems only)	142,143,144,146

* Options not available with 50 function lockout cylinder

+ Not available with R8200 Series

Note: Interchangeable core and removable core cylinders do not meet Security Grade 1 requirements

Cylinder Options

8200/R8200/7800 Mortise Locks

SARGENT
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Cylinder Options:

Categories	How to Specify	Detailed Description	Cylinder Sizes Available
Large Format Interchangeable Core	**60-**	Hardware to accept SARGENT permanent LFIC (removable core), disposable plastic core provided (permanent cores ordered separately)	42, 43, 44 & 46
	63-	Hardware provided with LFIC (removable core) cylinder - (Includes masterkeying, grand masterkeying)	42, 43, 44 & 46
	64-	Hardware provided with Keyed construction core to accept LFIC (removable) permanent core (ordered separately)	42, 43, 44 & 46
Small Format Interchangeable Cores	**70-***	Hardware to accept 6- or 7-Pin SFIC permanent cores, disposable plastic core provided	43 & 46
	72-*	Hardware to accept 6- or 7-Pin SFIC (keyed construction core provided) cylinder (permanent core ordered separately)	43 & 46
	73-*	Hardware provided with 6-Pin SFIC (Includes masterkeying, grand masterkeying)	43 & 46
	65-73-*	Hardware provided to accept uncombinated 6-Pin SFIC (permanent) core — (packed loose for field keying)	43 & 46
	65-73-7P-*	Hardware provided to accept uncombinated 7-Pin SFIC (permanent) core — (packed loose for field keying)	43 & 46
	73-7P-*	Hardware provided with Small Format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)	43 & 46
Keso & Keso F1	**81-***	Hardware provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores (permanent cores ordered separately)	172-174,176
	82-	Hardware provided with SARGENT Keso security cylinder	71-74,76
	F1-82-	Hardware provided with SARGENT Keso F1 security cylinder (patented)	71-74,76
	83-*	Hardware provided with SARGENT Keso security removable core cylinder	172-174,176
	F1-83-*	Hardware provided with SARGENT Keso F1 security removable core cylinder (patented)	172-174,176
	84-*	Hardware provided with SARGENT Keso construction cores (permanent cores ordered separately)	172-174,176
Additional Security	**BR-**	Bump resistant cylinder (available with conventional & conventional XC cylinders only)	–
Less Cylinder	**LC-**	Less cylinder – SARGENT supplies standard blocking rings for 1-1/8" cylinders (for longer cylinders order collars/rings separately)	–
Schlage Keyways	**SC-*^**	Schlage C keyway cylinder, 0 bitted	#41 Only
	SE-*^	Schlage E keyway cylinder, 0 bitted	#41 Only
Note: For V-10 Cylinders and information contact ASSA			

^ Options not available with Freewheeling Trim

* Options not available with 50 function lockout cylinder

Note: When using Interchangeable Core Cylinders, the ANSI/BHMA Cylinder Grade determines the grade of the lock, even if the lock is certified ANSI/BHMA Grade 1 with a standard cylinder

Cylinder Length	SARGENT Cylinder Sizes	Keso Cylinder Sizes	Keso R/C Cylinder Sizes
1-1/8"	#41	#71	N/A
1-1/4"	#42	#72	#172
1-3/8"	#43	#73	#173
1-1/2"	#44	#74	#174
1-3/4"	#46	#76	#176
2"	#48	N/A	N/A
2-1/4"	#50	N/A	N/A
2-1/2"	#52	N/A	N/A
2-3/4"	#54	N/A	N/A
3"	#56	N/A	N/A

How To Order, Finishes, Packaging & Security Screw Chart

8200/R8200/7800 Mortise Locks

SARGENT
ASSA ABLOY

How to Order 8200, R8200 & 7800 Mortise Locks

10-	82	71	12VDC	TR	MJ	15	RHR
Options*	**Series**	**Function**	**Voltage**	**Roses/ Escutcheons**	**Trim**	**Finish**	**Hand**
For all available options see Pages 36-38	82 R82 78 Mortise Lock	Pages 21-27 for Details	12VDC 24VDC	Pages 9-14 (With R8200, specify "R" for roseless design)	Levers — Pages 7-8, 10 FW Trim — Page 15, Push/Pull Trim — Page 16-17, Knobs — Page 20	Page 41	RHR
							RH
			Must be specified for Functions 70, 71, 72 & 73				LHR
							LH

* Multiple options can be selected

Finishes

Standard Levers & Knobs	BHW Trim	BHL Trim	BHD Trim	Studio Collection Lever Trim	8200 Coastal Series™ Trim and 8200 Freewheeling Trim	7800 Push/Pull Trim	Description	ANSI/BHMA
03				03	03	03	Polished brass, clear coated	605
04				04	04	04	Satin brass, clear coated	606
09				09	09	09	Polished bronze, clear coated	611
10				10	10	10	Satin bronze, clear coated	612
10B				10B	10B	10B	Oxidized bronze, oil rubbed	613
10BE				10BE	10BE		Dark oxidized satin bronze, equivalent	(613E)
10BL				10BL	10BL		Oxidized satin, bronze, clear coated	614
14				14	14		Polished nickel, clear coated	618
15 *				15 *	15 *		Satin nickel, clear coated	619
20D				20D	20D		Statuary dark bronze, clear coated	624
26				26	26		Polished chrome	625
26D *				26D *	26D *		Satin chrome	626
32	32	32	32	32		32	Polished stainless steel	629
32D *	32D *	32D *	32D *	32D *		32D *	Satin stainless steel	630
BSP				BSP	BSP		Black suede powder coat	—
WSP				WSP	WSP		White suede powder coat	—

* MicroShield® — optional designate SG- option (Available on 15, 26D, and 32D Finishes only)
Split Finishes — specify outside finish first, then inside finish example: US26D (outside) / US04 (inside)

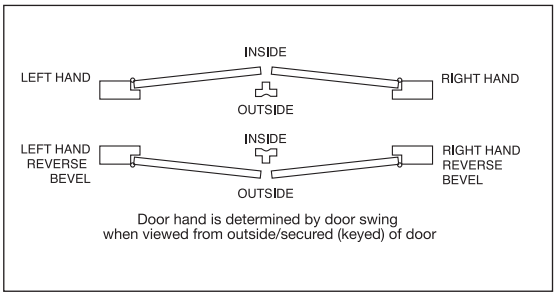
6 Lobe & Spanner Bit packs

Part Number	Descriptions
82-3855	6 Lobe Bit Pack 6 bits
82-3856	(sizes- T8, T9, T10, T15, T20, T25, T27) 9/32" Driver Spanner Bit Pack 5 bits (sizes- 6, 8, 10, 12, 14) 1/4" Driver

Packaging

8205 x LNL	approx. 6.1 lbs. (2.7kg)/box	6 boxes/case
8205 x WTL	approx. 7.2 lbs. (3.1kg)/box	6 boxes/case

Door Handing



Door hand is determined by door swing when viewed from outside/secured (keyed) of door

* Multiple options available
Wrought Box Strike optional — must order with lockset as WBS- option

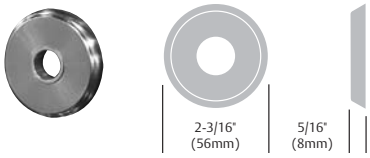
Coastal Series™ & Standard Trim

8200/R8200/7800 Mortise Locks

Coastal Series Roses & Escutcheons

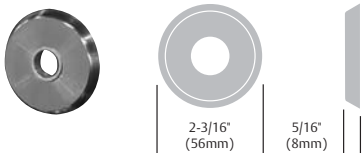
TR Traditional Rose

- Dual radii edge



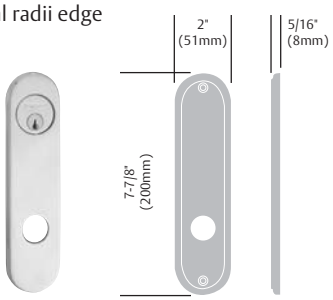
CR Contemporary Rose

- Beveled edge



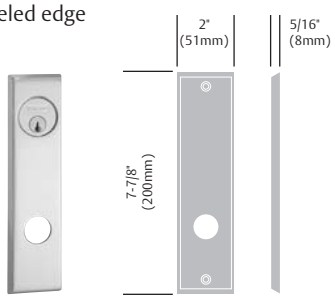
TE Traditional Escutcheon

- Dual radii edge



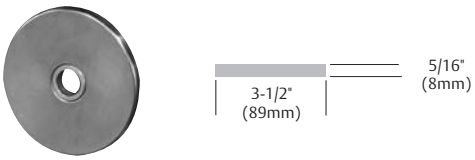
CE Contemporary Escutcheon

- Beveled edge

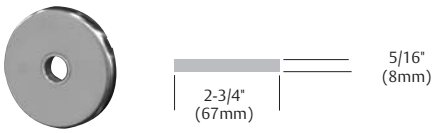


Standard Roses

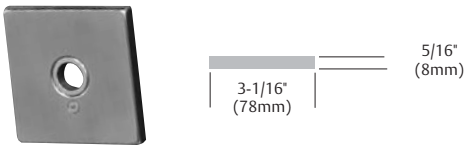
L Rose



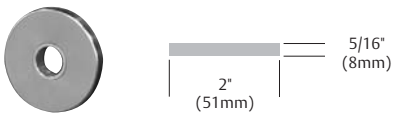
O Rose



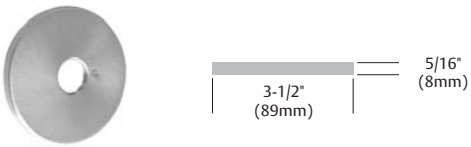
E Rose



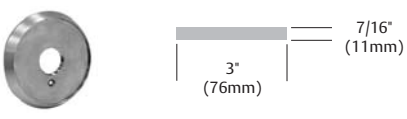
LN Rose



SL Rose



BH Rose



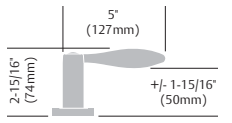
Coastal Series™ & Standard Levers

8200 Mortise Locks

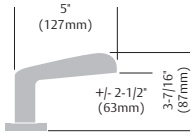
Coastal Series
(8200 & R8200 Series)

Features
- All levers meet ADA compliance for national codes
- Not available with CO and TO roses
- Levers are solid cast brass
- Finishes available – 3, 4, 9, 10, 10B, 10BE, 10BL, 14, 15, 20D, 26, 26D, BSP, WSP
- All lever height (+/- 1/16") measurements represent total distance from door face

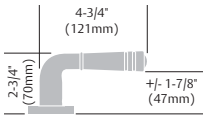
G - Gulfport™ (Handed)



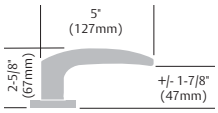
S - Sanibel™ (Handed)



R - Rockport™



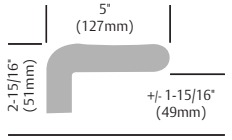
Y - Yarmouth™ (Handed)



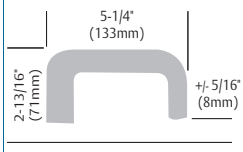
Standard Levers
(8200 Series Only)

Features
- All levers meet ADA compliance for national codes
- Solid forged or cast
- Lever designs J, L and P have lever returns within 1/2" (13mm) or less of door face and meet California State Reference Fire Code
- All lever height (+/- 1/16") measurements represent total distance from door face

A (Handed)



J



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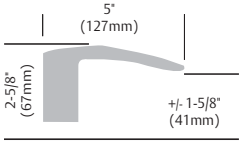

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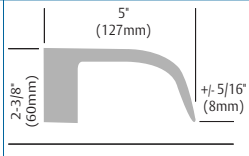
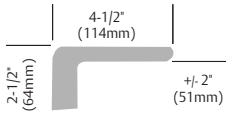


E



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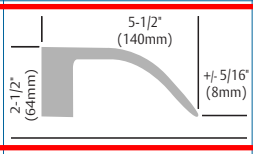
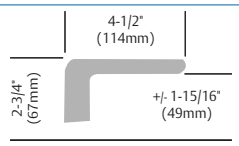
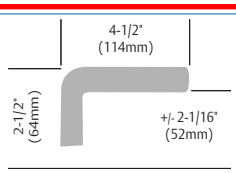


F



W



Electrical Functions & High Security Monitoring Options

8200/R8200/7800 Mortise Locks

SARGENT®
ASSA ABLOY

Electrified Mortise Locks with High Security Monitoring:

The high security monitoring options of our industry-leading Integrated Wiegand locks are now available in a mortise lock that can be used as a stand-alone electrified lock or in conjunction with a wall reader. Every NAC lock is shipped with door position and request to exit monitoring installed. NAC locks ordered with deadbolt are supplied with deadbolt monitoring.

Functions:

If the lock needs to have:	Then select:		
	Series	Type	Function
No key override and no deadbolt			
Fail Safe	NAC-	82	274
Fail Secure	NAC-	82	275
No key override with deadbolt			
Fail Safe	NAC-	82	284
Fail Secure	NAC-	82	285
Key override and no deadbolt			
Fail Safe	NAC-	82	270
Fail Secure	NAC-	82	271
Key override and deadbolt			
Fail Safe	NAC-	82	280
Fail Secure	NAC-	82	281

Description of Functions:

- Fail Safe: Power off, unlocks outside trim
- Fail Secure: Power off, locks outside trim
- Key Override: Key outside retracts latch and/or deadbolt when trim is locked electronically
- Deadbolt projected and retracted by thumbturn or key

High Security Monitoring Options

- **Internal End-of-Line Monitoring**

  Integrated directly into the mortise lock, internal end-of-line resistors monitor the line from the access control panel to the lock. Typically, resistors are installed at the panel or above the door, creating vulnerability between the resistors and the locks. Incorporating resistors within the lock eliminates any risk of undetected tampering or damage, while also reducing installation costs, simplifying specifications, and offering the assurance of a factory installed and tested product.

  Select a compatible resistor configuration and add the appropriate prefix to your order string:

  – **R01:** Mercury and Lenel compatible 1KΩ/2KΩ resistance supervision
  – **R03:** Software House compatible 1KΩ/2KΩ resistance supervision
  – **R04:** AMAG compatible 4-state supervision

- **Deadbolt Privacy Function (PHR-)**

  – Engaging the deadbolt disables remote access control unlocking (keypad or card reader) or scheduled unlock.
  – Ideal for personal privacy areas, such as nursing rooms, on-call doctors' rooms, restrooms, and shower areas
  – To order, add the PHR- prefix to your order string

Note: PHR is only available on Fail Secure functions

- **Integrated Door Position Switch (IDP-)**

  – The patented IDP option adds a magnetic door position switch in series with the internal auxiliary latch and latchbolt position switches to provide three factor monitoring.
  – This offers added assurance that the door is secure, reduces the likelihood of attack, and is aesthetically pleasing because it conceals the door position switch behind the front plate and the magnet behind the strike.
  – To order, add the IDP- prefix to your order string

Ordering Examples:

R01-IDP-NAC-82271-12V-LN-MD-26D-LHR

R04-PHR-IDP-NAC-82281-24V-LN-MD-26D-RHR

Product Catalog

SARGENT
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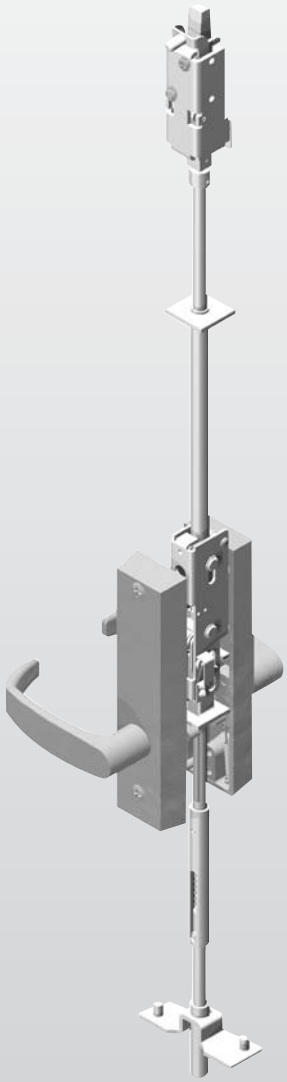
7000 Series
Multi-Point Lock



ASSA ABLOY, the global leader
in door opening solutions

Windstorm Certifications

7000 Series Vertical Rod Locks

Windstorm Certifications: Florida Building Codes & UL Listings

SARGENT Manufacturing's products meet building codes that require hurricane and windstorm certifications, including some of the most stringent building codes as specified in the Florida Building Code, Miami Dade Code and the International Building Code.

Florida Building Code: FL2998
UL Certification Directory: ZHEM.R21744 – Latching Hardware

ANSI/SDI-BHMA A250.13	"Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies"
ANSI/ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
(TAS) 201	"Impact Test Procedures"*
(TAS) 202	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
(TAS) 203	"Criteria for Testing Products Subject to Cyclic Wind Pressure Loading"*

* Published in the "Florida Building Code"

Cylinder Options

7000 Series Vertical Rod Locks

How to Order:

Options*	Series	Outside Function	Inside Function	Trim	Lever	Voltage for Electrified Trim**	Hand	Aux Control	Finish	Opening Height
11-NB-	70, AD70, or WD70	(select from chart below)	(select from chart below)	ER, ES, or ET	(refer to pages 3-5)	12VDC	RHR , LHR, RH, or LH	106 or 113	(select from chart below)	84"

* Multiple options may be selected
** Specify voltage desired for 73 & 74 function (12VDC/24VDC)
Note: Mounting height is 35-7/8" AFF standard

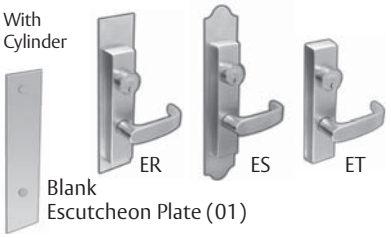
Finishes

Product	Description	BHMA
03	Polished brass, clear coat	605
04	Satin brass, clear coat	606
09	Polished bronze	611
10	Satin bronze, clear powder coat	612
10B	Oxidized bronze, oiled rubbed	613
10BE	Dark Oxidized Satin Bronze - Equivalent	(613E)
10BL	Oxidized Satin bronze, clear coat	614
14	Polished Nickel, clear coated	618
15*	Satin Nickel, clear coated	619
20D	Statuary bronze, dark	624
26	Polished chrome	625
26D*	Satin chrome	626
BSP	Black Suede Powder Coat	—

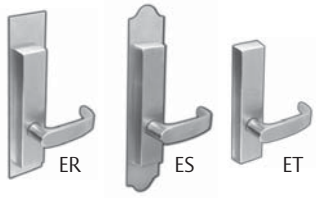
* Available with MicroShield®. Specify option as SG-

Trim Options

With Cylinder

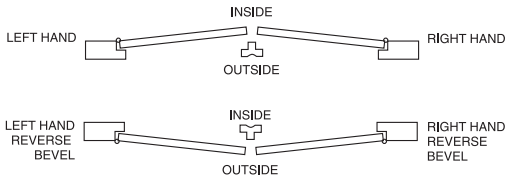


Without Cylinder



Handing

Door hands determined from outside of door or secured side.



Cylinder Options

7000 Series Vertical Rod Locks

Cylinder Options:

Large Format Interchangeable Core (Removable Core)	**60-**	Trim to accept SARGENT Permanent LFIC (Removable Core), Disposable plastic Core provided (Permanent Cores ordered separately)
	63-	Trim provided with LFIC (Removable Core) Cylinder - (Includes masterkeying, grand masterkeying)
	64-	Trim provided with Keyed construction core to accept LFIC (Removable) Permanent Core (ordered separately)
Small Format Interchangeable Core	**70-**	Trim to accept 6- or 7-Pin SFIC Permanent Cores, plastic disposable core provided
	72-	Trim to accept 6- or 7-Pin SFIC (6-Pin Keyed Construction Core provided) Cylinder (Permanent Core ordered separately)
	73-	Trim provided with 6-pin SFIC (Includes masterkeying, grand masterkeying)
	65-73-	Trim provided to accept Uncombinated 6-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	65-73-7P-	Trim provided to accept Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	73-7P-	Trim provided with Small Format 7-Pin Interchangeable Core (Includes masterkeying, grand masterkeying)
Keso & Keso F1	**81-**	Trim provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores. (Permanent Cores ordered separately)
	82-	Trim provided with SARGENT Keso Security Cylinder
	F1-82-	Trim provided with SARGENT Keso F1 Security Cylinder (Patented)
	83-	Trim provided with SARGENT Keso Security Removable Core cylinder
	F1-83-	Trim provided with SARGENT Keso F1 Security Removable Core cylinder (Patented)
	84-	Trim provided with SARGENT Keso Construction Cores (Permanent Cores ordered separately)
Added Security	**BR-**	Bump Resistant Cylinder (Available with Conventional & Conventional XC- Cylinders Only)
Less Cylinder*	**LC***	Less Cylinder - SARGENT supplies standard blocking rings for 1-3/8" Cylinders (For longer cylinders order collars/rings separately)
Schlage Keyways	**SC-**	Schlage C keyway cylinder, 0 bitted
	SE-	Schlage E keyway cylinder, 0 bitted
Degree Key System	**DG1-**	SARGENT Degree Key System Level 1 (Bump resistant with patented keys)
	DG1-21-	Degree Level 1 Construction Master Keying
	DG1-60-	Degree Level 1 Removable Disposable Construction Core
	DG1-63-	Degree Level 1 Removable Core
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC
	DG2-	SARGENT Degree Key System Level 2 (Geographically exclusive; bump and pick resistant)
	DG2-21-	Degree Level 2 Construction Master Keying
	DG2-60-	Degree Level 2 Removable Disposable Construction Core
	DG2-63-	Degree Level 2 Removable Core
	DG2-64-	Degree Level 2 Removable Construction Keyed LFIC
	DG3-	SARGENT Degree Key System Level 3 (Geographically exclusive; UL437 certified; bump and pick resistant)
	DG3-21-	Degree Level 3 Construction Master Keying
	DG3-60-	Degree Level 3 Removable Disposable Construction Core
	DG3-63-	Degree Level 3 Removable Core
	DG3-64-	Degree Level 3 Removable Construction Keyed LFIC
Signature Key System	**10-**	SARGENT Signature Key System (Not Available with other Key Systems)
	10-21-	SARGENT Signature Construction Key System (Lost Ball)
Signature: Large Format Interchangeable Core (Removable Core)	**10-63-**	SARGENT Signature LFIC (Removable Core) Cylinder

* Not available for 16 function

Mechanical Options

7000 Series Vertical Rod Locks

Cylinder Options (continued):

XC- Key System	**11-**	XC- Key System (Not available with other Key systems unless specified)
	11-21-	XC- Construction Key System (Lost Ball)
XC- Large Format Interchangeable Core (Removable Core)	**11-60-**	Trim to accept XC- Permanent LFIC (Removable Core), Disposable plastic Core- provided
	11-63-	Trim provided with XC- LFIC (Removable Core) Cylinder - (Includes masterkeying, grand masterkeying)
	11-64-	Trim provided with Keyed construction core to accept XC- LFIC (Removable) Permanent Core (ordered Separately)
XC- Small Format Interchangeable Core	**11-70-7P-**	Trim to accept XC- SFIC (7-Pin) XC- Permanent Cores, plastic disposable core provided
	11-72-7P-	Trim to accept XC- SFIC (7-Pin Keyed Construction Core provided) cylinder Permanent core ordered separately
	11-73-7P-	Trim provided with XC- Small Format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)
	11-65-73-7P-	Trim provided to accept XC- Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose)
Construction Key Systems	**21-**	SARGENT Lost Ball Construction Keying for Conventional, XC- and Signature Series (N/A with 63- or 73-)
	22-	SARGENT Construction Split Key System for Conventional Cylinders (Existing Systems Only) (N/A with 10-, 11-, 63- or 73-)
Old Style Removable Core	**51-**	Removable Core Cylinder (Old Style) provided (existing systems only)
	52-	Removable Construction Core (Old Style) Permanent core ordered separately (existing systems only)

Mechanical Options:

UL Listings	***12-**	UL Fire Label Exit hardware
	HC	Hurricane-Resistant (available on metal doors only; Maximum openings 8'0" x 8'0")
	WS	Windstorm Resistant (available on metal doors only; Maximum openings 8'0" x 8'0")
Thick Doors	**31-**	Doors over 1-3/4" and/or Panels^ (Specify door thickness, panel thickness & location as required)
Security Fasteners	**36-**	Six lobe security head screws
	37-	Spanner head screws
Electrical Options	**53-**	Latchbolt monitoring switch
	54-	Monitors outside lever with micro switch in the control
	55-	Monitors inside lever with micro switch in the control
	ELR	Electric Latch Retraction
Tactile Warning Options	**75-**	Tactile Warning - Milled Inside Lever (Not available with Studio & Coastal Levers and the A Lever)
	76-	76- Tactile Warning - Milled Outside Lever (Not available with Studio & Coastal Levers and the A Lever)
	77-	77- Tactile Warning - Milled Inside & Outside Levers (Not available with Studio & Coastal Levers and the A Lever)
	85-	85- Tactile Warning - Abrasive coating on Inside Lever
	86-	86- Tactile Warning - Abrasive coating on Outside Lever
	87-	87- Tactile Warning - Abrasive coating on Inside & Outside Levers
	88-	88- Lever Hold Back (Not available with 12-)
Finish Protection	**CPC-**	Clear Powder Coat (Available for 26, 26D, 32 & 32D Finishes)
	****SG-**	MicroShield® antimicrobial clear powder coat
Top Rod Only	**NB-**	No bottom rod

* One thermal pin is supplied with each 12-NB-WD7000 device for double door application. Fire Rated 12-NB-WD7000 is not available on single door applications
** Available on 15 and 26D finishes only
^ ELR is not available on doors with panels

ET, ER & ES Trims and Standard & Coastal Lever Designs

7000 Series Vertical Rod Locks

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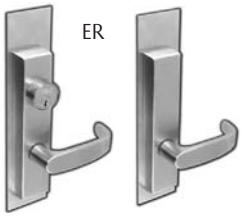
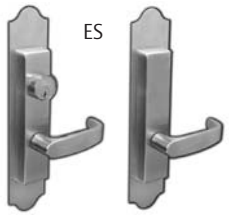
ER & ES Controls are ET Controls with back plates.

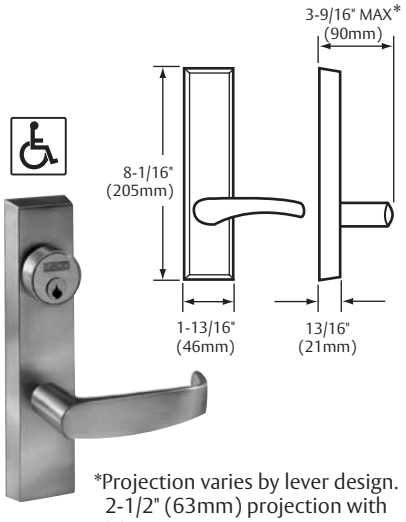
The back plates are:
- Mounted between the trim and the door
- Required for wood doors (WD-)
- Optional on metal doors

Note: May be used to cover existing door preps





ER, ES & ET Lever Controls



*Projection varies by lever design. 2-1/2" (63mm) projection with L Lever

Easy operating lever handle allows convenient one hand operation. Coastal, Studio & standard levers are either brass or bronze. Stainless steel levers are available in standard designs only. The control is brass, plated as required.

Features EcoFlex® Technology.

The outside trim is specified as a -2 control with function specified (e.g., 713-2 ET, 713-2 ER & 713-2 ES x lever design, hand & finish).

The inside control is a MP and -2 control with function specified (e.g., MP715-2 ET, MP715-2 ER or MP715-2 ES x lever design, hand & finish).

Note: 73 & 74 functions require the voltage to be specified, 12V or 24V.

100 Series Aux Control

- 100 Series Control offers key override for 01, 10, 40, 73 & 74 function devices
- Available functions are 06 & 13
- Supplied with a SARGENT #41 mortise cylinder

Standard Levers

A Lever Design

- Lever: A-Solid forged or cast
- Must specify hand when ordering

B Lever Design

- Lever: B-Solid forged or cast

E Lever Design

- Lever: E-Solid forged or cast

F Lever Design

- Lever: F-Solid forged or cast

J Lever Design

- Lever: J-Solid bar stock

L Lever Design

- Lever: L-Solid forged or cast

P Lever Design

- Lever: P-Solid forged or cast

W Lever Design

- Lever: W-Solid bar stock

Coastal Series™ Levers

- Solid Cast Brass

G - Gulfport™

- Must specify hand when ordering

R - Rockport™

S - Sanibel™

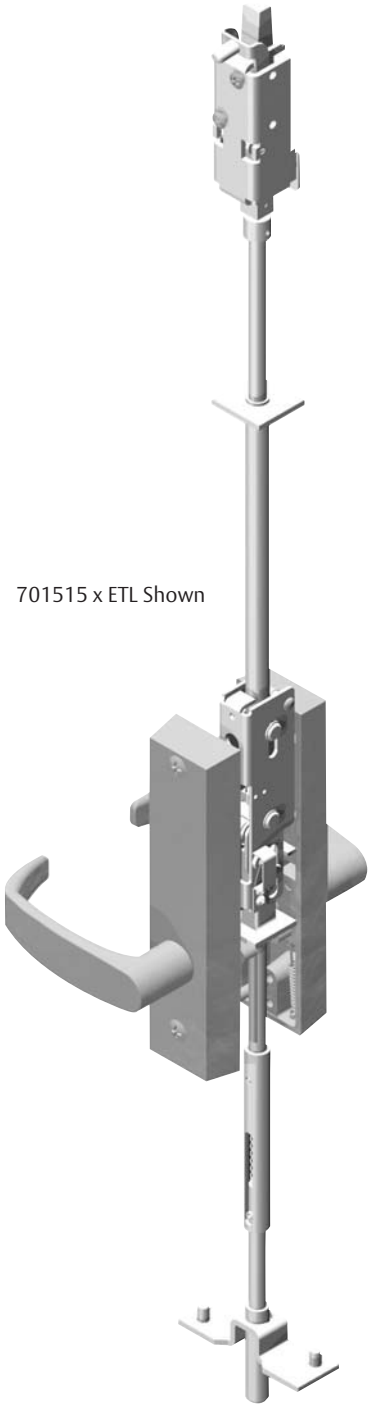
- Must specify hand when ordering

Y - Yarmouth™

- Must specify hand when ordering

Features and Specifications

7000 Series Vertical Rod Locks for Aluminum Doors (AD70)



701515 x ETL Shown

Features

- Designed for aluminum door applications
- Concealed rods offer additional security
- Less bottom rod option available, specified as NB-AD 7000
  (For single door applications, consult factory)
- NB- provides free access for wheel chairs and carts
- Single or double door applications

Specifications

For Doors*	Aluminum doors, 1-3/4" (44mm) door thickness standard, 2-3/4" minimum stile for single doors, 2-1/2" minimum stile for double doors, 7/8" backset standard for double doors, 1-1/8" backset for single doors
Mounting	Supplied fasteners are for metal doors with through-bolts for trim
Hand	Field reversible; specify RHR, LHR, RH or LH
Top and Bottom Bolts	Stainless steel. Top and bottom bolt travels 7/16" (11mm) Projection adjustable up to 1" (25mm)
Latching	Top and bottom (AD 7000) or Top only (NB-AD 7000)
Fire Exit Hardware	See Chart page 1
Trim	ET, ER & ES Controls are available with all lever designs. 100 Series Auxiliary Control offer cylinder override for 01, 10, 40, 73 & 74 function devices
Functions	01, 06, 10, 13, 15, 16 40, 43, 46 Freewheeling 73, 74, Electrical+
Strikes	640 Top and Bottom Strike, 639 Top Strike only, standard
Cylinder	#41 Mortise Cylinder

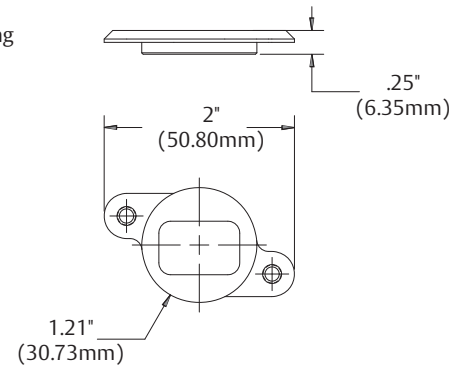
* Consult door manufacturer
+ See page 10 for details

When ordering always specify:

- Opening height (Standard opening height 96")
- AFF - Above Finished Floor - Centerline of lever to finished floor or threshold (Standard 35-7/8" AFF)

639/640 Strike Kits

- Steel with Black Nylon Coating
- Machine Screws Supplied
- 640 Kit contains 2 strikes (Top & Bottom)
- 639 Kit contains 1 strike (Top Only)



Product Catalog

SARGENT
ASSA ABLOY

80 Series
Exit Device

ASSA ABLOY, the global leader
in door opening solutions

Windstorm Certifications

80 Series

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ASSA ABLOY

Windstorm Certifications: Florida Building Codes & UL Listings

SARGENT Manufacturing's products meet building codes that require hurricane, windstorm and FEMA certifications, including some of the most stringent building codes as specified in the Florida Building Code, Miami Dade Code and the International Building Code. Listed below are certifications and standards met by the 80 Series lock.

Florida Building Code: FL2998
UL Certification Directory: ZHEM.R21744 – Latching Hardware

ANSI/SDI-BHMA A250.13	"Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies"
ANSI/ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
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* Published in the "Florida Building Code"

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

UL Certification Directory: ZHLL.R21744 – Products for Use in Windstorm-rated Assemblies

Certifications to meet assembly requirements are done in conjunction with doors from ASSA ABLOY Group companies CECO DOOR and CURRIES.

ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
AAMA/WDMA/CSA 101/I.S.2/A440	"Standard/Specification for Windows, Doors, and Unit Skylights"
FEMA Publication 320 (2014)	"Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business", investigated with respect to impact and pressure requirements only.
FEMA Publication 361 (2015)	"Design and Construction Guidance for Community Safe Rooms", investigated with respect to impact and pressure requirements only.
ICC 500 (2014)	"ICC/NSSA Standard for the Design and Construction of Storm Shelters", investigated with respect to impact and pressure testing. Minimum missile impact speeds vary with the design wind speed desired for a particular product. The information below correlates design wind speed to the minimum missile speeds as discussed in Table 305.1.1 of ICC 500

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

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Cylinder Information for Exit Devices

Cylinder Chart: Exit Device Series x Function		ET Trim (700 Series Auxiliary Control)		PTB, PSB, STS, MAL, MSL, FLL, FSL, FLW, FSW	
	Door Thickness	1-3/4" (44mm)	2-1/4" (57mm)	1-3/4" (44mm)	2-1/4" (57mm)
Narrow Stile Mortise Exit Device	8304	46	48	41	43
	8313/8343	41	41	Not Available	
	8344	46	48	Not Available	
	8363	Not Available		41	43
	8375/8376	46	48	Not Available	
Narrow Stile CVR Exit Device	All 8400	41	41	Not Available	
Narrow Stile Rim Exit	8504	34	34	Not Available	
	8513/8543	41	41	Not Available	
Concealed Vertical Rod Exit Devices	All LP/LR/LS8600	41	Not Available		
	All SP/PP/PR8600	41		Not Available	
	All AD, MD & WD8600	41	41	Not Available	
Surface Vertical Rod Exit Devices	8706/8713/8743/8746	41	41	Not Available	
	8762/8763	Not Available		34	34
	All SP/PP/PR8700	41	N/A	Not Available	
Rim Exit Devices	8804	34	34	34	34
	8806/8813/8843/8846	41	41	Not Available	
	8816	34/*44	34/*44	Not Available	
	8844	34	34	Not Available	
	8863	Not Available		34	34
	8866	Not Available		34/*44	34/*44
	8875/8876/8877	34	34	Not Available	
Mortise Lock Exit Devices	8904	46	48	41	43
	8913/8943	41	41	Not Available	
	8916	*34/46	*34/48	Not Available	
	8944	46	48	Not Available	
	8963	Not Available		41	43
	8966	Not Available		*41/34	*43/34
	8975/8976	46	48	Not Available	

* Inside Cylinders
Chart shows cylinder type and size for conventional SARGENT cylinders.
Note: Cylinder sizes & types are limited, as noted: SC- & SE- cylinders are available in size 41
60-, 63- & 64- cylinders are available in sizes 42, 43, 44 & 46
70-, 11-70-, 72-, 11-72-, 73- & 11-73 cylinders are available in sizes 43 & 46
Note: The 8888's Lever & Rose Trim cylinder standard is the standard SARGENT 10 Line cylinder (13-3266)
Note: 41 Cylinder is 1-1/8" in length; For each additional digit, the cylinder is a 1/8" longer. Example: 42 is 1-1/4"; 43 is 1-3/8" and 46 is 1-3/4"
Note: SARGENT supplies standard blocking rings. Specify if using competitor cylinders

Mullions: Aluminum, Steel and Electrified

80 Series

SARGENT®
ASSA ABLOY

Aluminum Mullions

Product Designation	650A	980	L980
Description	Removable	Removable	Lockable
Material	Aluminum	Aluminum	Aluminum
Standard Finish	US28/Satin Anodized Aluminum	Prime Coat	Aluminum Prime Coat
Options	Specify "650A x 10B" for 313AN to match 10B	Specify "980A" for Anodized US28/ Satin Aluminum	Specify: "L980A" Anodized Aluminum Specify: "L980A x10B" for 313AN to match 10B
Stk Size	96"	96"	96"
Max Stk Height	120"	120"	120"
Pre-prepped	658 Strikes Included	No	No
Cylinder Size	Not Required	Not Required	#41
Shape	1-1/2" x 2-1/2"	T Shaped 2-1/2" x 3"	T Shaped 2-1/2" x 3"
Misc. Information and Accessories	Includes 651 Stabilizers and imbedded Weather Stripping Top Retainer 94-2050 Bottom Retainer 94-2051	Top Retainer - 511 Bottom Retainer - 502 Adapter for narrow transom: 507 - Aluminum Prime Coated 507A - Anodized Aluminum	All Cylinder Options Available Wall Mount Kit 98-2578 Top Ret Pack 98-2526 Bottom Ret Pack 98-2525 Cylinder Kit 980C1*

Electrified

EL980
Electrical Lockable
Steel
Gray Paint
Wall Mounting Kit: 98-2580 Top Ret Pack :98-2559
96"
120"
No
#46 Only
Rectangular 2" x 3"
For use with Electric Strikes and Monitoring, Quick Connect Wiring Supplied Cylinder Kit 980C2*

***Note:** Cylinder Kits must be ordered separately

Steel Mullions

Product Designations	HC980	980S	L980S	HCL980	12-HD980
Description	Hurricane Code	Standard Mullion	Lockable	Lockable Hurricane Code	Heavy Duty
Material	Steel	Steel	Steel	Steel	Steel
Fire Rated	Specify 12-HC980	Specify 12-980	Specify 12-L980	Specify 12-HCL980	Specify 12-HD980
Fire Rated Max Height	96"	96"	96"	96"	120"
Finish	Gray Paint	Gray Paint	Gray Paint	Gray Paint	Gray Paint
Stk Size	96"	96"	96"	96"	120"
Max Stk Height	96"	120"	120"	96"	120"
Pre-prepped	No	No	No	No	No
Cylinder Size	Not Required	Not Required	#41 Std (#42 & #43 available)	#41 Std (#42 & #43 available)	Not Required
Shape	Rectangular 2' x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"
Misc. Information	Designed for severe wind load conditions due to hurricanes or windstorms. Tested to Dade County Protocols & ASTM Standards	For 12-8800 - Channel Iron & Malleable iron top & bottom retainers.	Fire rated for 8'0" x 8'0" paired openings	See Notes Below	12-HD980 is for pair of doors over 8'0" to 10'0" for use with 2-8800 Rim Exits includes two piece strikes
Accessories	Top Ret Pack - 98-2599 Bottom Ret Pack - 98-2600 Top Retainer Shim Kit - 601	Top Ret Pack - 98-2190 Bottom Ret Pack - 98-2191 Top Retainer Shim Kit - 601	Wall Mounting Kit - 98-2579 Top Ret Pack - 98-2559 Bottom Ret Pack - 98-2556 Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	- Top Retainer Pack: 98-2593 - Bottom Retainer Pack: 98-2594 - Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	Top Ret Pack - 98-2599 ottom Ret Pack - 98-2600 op Retainer Shim Kit - 601

***Note:** Cylinder Kits must be ordered separately

Note for HC980/12-HC980 Mullions:

- Designed for severe wind load conditions due to hurricanes or tornadoes
- Tested to Dade County protocols and ANSI 250.13 ASTM Standards and FEMA 361
- 12- Fire labeled version
- Replacement lock kits are available for lockable mullions Part numbers for each model are listed in the price book

HCL980 Mullion Information

- Model 12-HC-L980 may be supplied for doors UL fire rated up to and including 3 hrs not exceeding 8 ft in width and height
- Meets the following standards: ANSI 250.13, ASTM E330, ASTM 1886, ASTM 1996, TAS 201, TAS 202 & TAS 203
- Designed for use with UL Classified HC8810, HC8800 and 12-HC8800 rim exit devices

Mullion Accessories and Stabilizers

80 Series

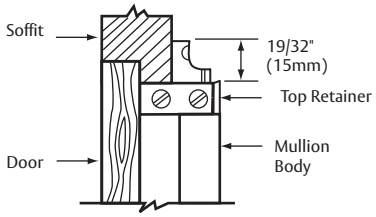
SARGENT
ASSA ABLOY

Mullion Accessories

RK980
Latchbolt assembly retrofit kit with top and bottom retainers for 980 aluminum mullion

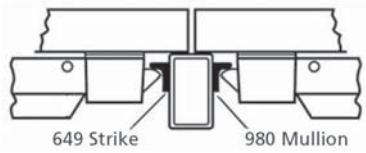
507 Narrow Transom Bars Adapter

- Available with 980 and 980A
- Required when soffit is 1-1/4" (32mm) to 2" (51mm) wide
- Order as a: 507 for 980 mullion or 507A for 980A mullion



980S Mullion Application

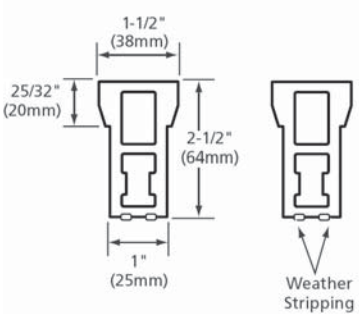
- All steel mullions are 2" x 3"



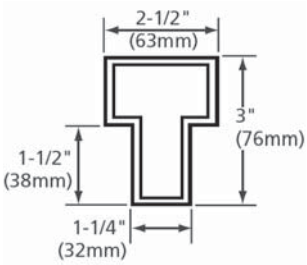
651 Mullion Stabilizer Kit

- Stabilizer block
- Furnished standard w/650A Mullion
- Order as a 651 Kit

650A Mullion



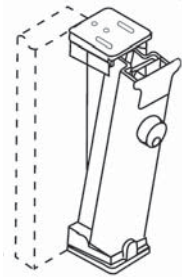
980 Mullion & L980 Lockable Mullion



980C1 Cylinder Mullion Kit

- Lockable mullions only
- Aluminum and steel
- Includes cylinder and collar
- Available in 26D & 10B finish

Lockable Mullion



Lockable Mullion Cylinder Kit Options*

L980, L980A, L980S & HC-L980 mullions are available with these options: 10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82-, F1-82-, 83-, F1-83-, 84-, SC- & SE-.

EL980 mullion is available with these options: 10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82- & F1-82-.

*Lockable mullions are shipped without cylinders. Order Cylinder Mullion Kit separately.

980C2 Cylinder Mullion Kit

- Lockable mullions
- Electrified only
- Includes cylinder and collar
- Available in 26D finish only

Mullion Weights & Packaging

Product	Avg Wt	Case
Exit Device with Trim	15 lbs	1 ea
980 Mullion	18 lbs	1 ea
12-980 Mullion	40 lbs	1 ea
650A Mullion	18 lbs	1 ea

Mechanical Options and Descriptions

80 Series

Mechanical Options:

Categories	How to Specify	Detailed Description
Fire Rated	**12-**	UL Fire Label Exit hardware (not available with 16- & HK-)
SVR Bolt	**14-**	Sliding bolt bottom case for 8700
Cylinder Dogging	**16-**	Cylinder lockdown with # 41 Cylinder & # 97 Ring (not available with 12-, 57, 59-, AL- or BT- Option)
	LD-	Less dogging for non fire rated devices
Less Touch Pad	**19-**	Pushbar without Lexan touchpad (not available TL-)
8900/8300 Strike	**23-**	4-7/8" (124mm) ANSI flat lip strike (for 8900 & 8300 Series Mortise Lock Exit Devices)
Thick Doors	**31-**	Doors over 1-3/4" and/or Panels (Specify door thickness, panel thickness & location as required) Not available for HC8700, FM8700, PP, PR & SP8700, PP, PR & SP8600, LP, LR & LP8700 Extended lip strike supplied for 8300 & 8900 Series
Security Fasteners	**36-**	Six lobe security head screws
	37-	Spanner head screws
Flush End cap	**43-**	Flush End Cap (Not available with LP, LR & LS Devices)
Indicator	**49-**	Indicator (Available on 8816 and 8866 functions only)
Electrical Options	**53-**	Latchbolt monitoring switch (not available with 59-, GL-, HC-, WS- or on FM8700, PP/PR/SP8600 & LP/LR/LS8600 Exit Devices)
	54-	Monitors ET Lever movement with Internal micro switch in ET Control
	55-	Request to Exit - Signal Switch in Rail (not available with 59- & FM8700)
	56-	Remote Latch Retraction (not available 57-, 58-, 59-, AL- or BT- Option)
	56-HK-	Remote Latch Retraction with manual Hex Key dogging (not available 12-, 57-, 58-, 59-, AL- or BT- Option)
	57-	Delayed Egress (Electromagnetic Lock required & purchased separately) (not available 16-, 53-, 56-, 56-HK, 58-, 59-, AL, Bc-59 - or BT, GL, TL Prefixes) (NB, 54- are available on request)
	58-	Electric Rail Dogging (Not available 56- & 59-)
	59-	Electroguard® Self Contained Delayed Egress Device (not available with 16-, 53-, 55-, 56-, 57-, 58-, AL-, BT-, GL-, HC- & WS Option Prefixes, PP/PR/SP8600, LP/LR/LS8600 Exit Devices) (NB, 54- are available upon request)
	AL-	Alarmed Exit (Not available 16-, 56-, 57-, 59-, BT-, GL-, HC- & WS-)
	BC-59-	Electroguard® Boca Code (Door Status Switch required) (not available with 16-, 55-, 56-, 57-, 58-, AL-, BT-, GL-, HC- & WS-Options and on NB8700, PP/PR/SP8600 & LP/LR/LS8600 Exit Devices)
	TL-	SARGuide Electro-Luminescent Touchpad (not available 19-, 85-, 87- & PL-)
Tactile Warning Options	**76-**	Tactile Warning - Milled Outside Lever (not available with Studio & Coastal Levers and the A Lever)
	85-	Tactile Warning - Abrasive strip on Push Rail (Not available with PL- & TL-)
	86-	Tactile Warning - Abrasive coating on Outside Lever
	87-	Tactile Warning - Abrasive strip on Push Rail & Abrasive coating on Outside Lever (not available with PL- & TL-)
Finish Protection	**CPC-**	Clear Powder Coat (Available for 32 & 32D Finishes)
	SG-	MicroShield® antimicrobial clear powder coat (only available with 15, 26D and 32D finishes)
Top Rod Only	**NB-**	Less Bottom Rod & Bolt (for SVR & CVR Devices)
Guarded Latch	**GL-**	Guarded Latch for Rim Exit Devices (not available 53-, 56-, 59-, AL-, HC- & WS-)
SARGuide	**PL-**	SARGuide™ PL – Photoluminescent Coated Push Rail – (Touchpad eliminated) (not available 85, 87 & TL-)
Through Bolts	**TB-**	Through Bolts for 8300, 8500, 8600, 8700, 8800 & 8900 Devices
Rail Force	**5CH-**	5lb. Pressure Release (8800 only)

SARGENT®
ASSA ABLOY

Cylinder Options and Descriptions

80 Series

Cylinder Options:

Conventional Cylinder	-	SARGENT Conventional Cylinders Supplied Standard (Unless Otherwise Specified)
Degree Key System	**DG1-**	SARGENT Degree Key System Level 1 (bump resistant with patented keys)
	DG1-21-	Degree Level 1 Construction Master Keying
	DG1-60-	Degree Level 1 Removable Disposable Construction Core
	DG1-63-	Degree Level 1 Removable Core
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC
	DG1-65-	Degree Level 1 Unassembled/Uncombined Core
	DG2-	SARGENT Degree Key System Level 2 (geographically exclusive; bump and pick resistant)
	DG2-21-	Degree Level 2 Construction Master Keying
	DG2-60-	Degree Level 2 Removable Disposable Construction Core
	DG2-63-	Degree Level 2 Removable Core
	DG2-64-	Degree Level 2 Removable Construction Keyed LFIC
	DG2-65-	Degree Level 2 Unassembled/Uncombined Core
	DG3-	SARGENT Degree Key System Level 3 (geographically exclusive; UL437 certified; bump and pick resistant)
	DG3-21-	Degree Level 3 Construction Master Keying
	DG3-60-	Degree Level 3 Removable Disposable Construction Core
	DG3-63-	Degree Level 3 Removable Core
	DG3-64-	Degree Level 3 Removable Construction Keyed LFIC
	DG3-65	Degree Level 3 Unassembled/Uncombined Core
Signature Key System	**10-**	SARGENT Signature Key System (Not Available with other Key Systems)
	10-21-	SARGENT Signature Construction Key System (Lost Ball)
Signature- LFIC	**10-63-**	SARGENT Signature Large Format Interchangeable Core Cylinder (Removable)
XC- Key System	**11-**	XC Key System (Not available with other Key systems unless specified)
	11-21-	XC- Construction Key System (Lost Ball)
XC- Large Format Interchangeable Core (Removable Core)	**11-60-**	Device to accept XC- Permanent Large Format Interchangeable Core, Disposable plastic Core- provided
	11-63-	Device provided with XC- Large Format Interchangeable Core Cylinder - (Includes masterkeying, grand masterkeying)
	11-64-	Device provided with Keyed construction core to accept XC- Permanent Large Format Interchangeable Core (ordered separately)
XC- Small Format Interchangeable Core	**11-70-7P-**	Device to accept XC- SFIC (7-Pin) XC- Permanent Cores, plastic disposable core provided
	11-72-7P-	Device to accept XC- SFIC (7-Pin Keyed Construction Core provided) cylinder Permanent core ordered separately
	11-73-7P-	Device provided with XC- Small Format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)
	11-65-73-7P-	Device provided to accept XC- Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose)
Construction Key Systems	**21-**	SARGENT Lost Ball Construction Keying for Conventional, XC and Signature Series (N/A with 63- or 73-)
	22-	SARGENT Construction Split Key System for Conventional Cylinders (Existing Systems Only) (N/A with 10-, 11-, 63- or 73-)
Old Style Removable Core	**51-**	Removable Core Cylinder (Old Style) provided (existing systems only)
	52-	Removable Construction Core (Old Style) Permanent core ordered separately (existing systems only)
Large Format Interchangeable Core (Removable Core)	**60-**	Device to accept SARGENT Permanent Large Format Interchangeable Core, Disposable plastic Core provided (Permanent Cores ordered separately)
	63-	Device provided with Large Format Interchangeable Core Cylinder - (Includes masterkeying, grand masterkeying)
	64-	Device provided with Keyed construction core to accept Permanent Large Format Interchangeable Core (ordered separately)
Small Format Interchangeable Core	**70-**	Device to accept 6- or 7-Pin SFIC Permanent Cores, plastic disposable core provided
	72-	Device to accept 6- or 7-Pin SFIC (6-Pin Keyed Construction Core provided) Cylinder (Permanent Core ordered separately)
	73-	Device provided with 6-Pin SFIC (Includes masterkeying, grand masterkeying)
	65-73-	Device provided to accept Uncombinated 6-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	65-73-7P-	Device provided to accept Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	73-7P-	Device provided with Small Format 7-Pin Interchangeable Core (Includes masterkeying, grand masterkeying)
Keso & Keso F1	**81-**	Device provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores. (Permanent Cores ordered separately)
	82-	Device provided with SARGENT Keso Security Cylinder
	F1-82-	Device provided with SARGENT Keso F1 Security Cylinder (Patented)
	83-	Device provided with SARGENT Keso Security Removable Core cylinder
	F1-83-	Device provided with SARGENT Keso F1 Security Removable Core cylinder (Patented)
	84-	Device provided with SARGENT Keso Construction Cores (Permanent Cores ordered separately)
Added Security	**BR-**	Bump Resistant Cylinder (Available with Conventional & Conventional XC Cylinders Only)
Less Cylinder	**LC-**	Less Cylinder - SARGENT supplies standard blocking rings for 1-1/8" Cylinders (For longer cylinders order collars/rings separately)
Schlage Keyways	**SC-**	Schlage C keyway cylinder, 0 bitted (not available with: 8904, 8916, 8944, 8975, 8976, 8866, 8304, 8344, 8375 & 8376)
	SE-	Schlage E keyway cylinder, 0 bitted (not available with: 8904, 8916, 8944, 8975, 8976, 8866, 8304, 8344, 8375 & 8376)
Lever to Accept Schlage	**SF-**	L Lever to accept MEDECO KeyMark Large Format Interchangeable and Schlage Full Size Interchangeable Core (Supplied Less Cylinder, but with tailpiece needed) (Available for 88-KLL & 88-CLL)

Note: For V-10 Cylinders and information, contact ASSA

MD8600(Windstorm Rated) and NB-MD8600 Concealed Vertical Rod Exit Device for Metal Doors

80 Series

SARGENT®
ASSA ABLOY

MD8600 Series

Concealed Vertical Rod Exit Device for Metal Doors

Features

- Designed for standard width stile applications on hollow metal doors
- Concealed rods for security and aesthetics
- Single and double door applications
- Specify NB- for less bottom rod
  – NB not available with HC and WS options
- Devices are ANSI A156.3 - Grade 1
- UL Fire and Panic listed

Specifications for MD8600 & NB-MD8600 Series Exit

Door Type	Metal Doors
Door Thickness	1-3/4" (44mm) minimum thickness. For doors over 1-3/4" to 2-1/4" thick, specify thickness and order as 31-
Cladding	Available for 1/4" on 1/2" panels. Specify 31- and panel thickness on order. Only available on 1-3/4" door thickness. Must be noted separately from door thickness on order string.
Stile	4-1/2" (114mm) minimum stile width
Rail sizes as determined by door width	Rails are available in 4 sizes, use door width to determine size needed. Rails will be factory cut to size, if door width is supplied • E Rail for 24" to 32" door widths, No cutting required for 32" door • F Rail for 33" to 36" door widths, No cutting required for 36" door • J Rail for 37" to 42" door widths, No cutting required for 42" door • G Rail for 43" to 48" door widths, No cutting required for 48" door
Strike	650 Top Strike & 606 Bottom Strike (Panic and Fire Rated)
Dogging Feature	Hex key dogging standard on non fired rated devices; specify 16- for cylinder dogging (#41 cylinder supplied)
Electric Options	AL- Alarm PL- SARGuide™ Photoluminescent Coated TL- SARGuide™ Illuminated Touchpad 53- LX Latchbolt Monitor 54- Outside Lever Monitoring 55- Request-to-Exit Signal - Rail Monitoring 56- Remote Latch Retraction 57- Delay Egress & Electromagnets 58- Electric Dogging 59- Electroguard – Self Contained Delayed Egress
Mounting Fasteners	Supplied standard with machine screws
Top Bolt	Stainless steel
Device Centerline from Finished Floor	41" (1041mm) for Standard Applications 38" (965mm) for elementary schools
Door/Opening Height	**Must be specified** - 120" (3048mm) Max Door Opening 96" max door height for HC and WS options
Center Case Dimensions	8-3/8" (213mm) x 2-5/8" (67mm)
Projection	Pushbar Neutral – 3" (76mm) Pushbar Depressed – 2-1/8" (54mm)
Fire Exit Hardware	See Chart – Page 6

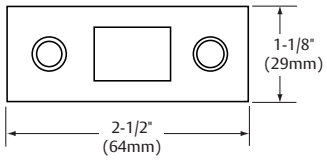
Note: MD8600 & 12-MD8600 can be used as NB- Device by simply not installing the bottom rod/bolt
Note: 12-NB Applications require thermal pin. Thermal Pin supplied when ordered as a 12-NB Device.

100 Series Aux Control

- Available as an 06 or 13 function
- Supplied with a SARGENT #41 Mortise Cylinder
- Can be used with any SARGENT Mortise Key System

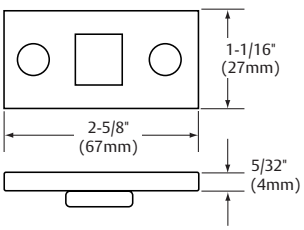
650 Top Strike

- For application in hollow metal frames
- Stainless steel nylon coated



606 Bottom Strike

- Furnished with expansion shields
- Mortised into floor
- Stainless steel



MD8600 (Hurricane-Resistant) Concealed Vertical Rod Exit Device for Metal Doors

80 Series

SARGENT®
ASSA ABLOY

MD8600 Series
Concealed Vertical Rod Exit Device for Metal Doors

Features

- Designed for standard width stile applications on hollow metal doors
- Concealed rods for security and aesthetics
- Single and double door applications
- Devices are ANSI/BHMA A156.3 - Grade 1
- UL10C (Fire) and UL305 (Panic) listed

Specifications for MD8600 & NB-MD8600 Series Exit

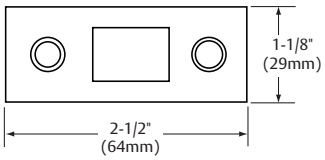
Door Type	Metal Doors
Door Thickness	1-3/4" (44mm) minimum thickness. For doors over 1-3/4" to 2-1/4" thick, specify thickness and order as 31-
Stile	4-1/2" (114mm) minimum stile width
Rail sizes as determined by door width	Rails are available in 4 sizes, use door width to determine size needed. Rails will be factory cut to size, if door width is supplied • E Rail for 24" to 32" door widths, No cutting required for 32" door • F Rail for 33" to 36" door widths, No cutting required for 36" door • J Rail for 37" to 42" door widths, No cutting required for 42" door • G Rail for 43" to 48" door widths, No cutting required for 48" door
Strike	650 Top Strike & 606 Bottom Strike (Panic and Fire Rated)
Dogging Feature	Hex key dogging standard on non fired rated devices; specify 16- for cylinder dogging (#41 cylinder supplied)
Electric Options	AL- Alarm PL- SARGuide™ Photoluminescent Coated TL- SARGuide™ Illuminated Touchpad 53- LX Latchbolt Monitor 54- Outside Lever Monitoring 55- Request-to-Exit Signal - Rail Monitoring 56- Remote Latch Retraction 57- Delay Egress & Electromagnets 58- Electric Dogging 59- Electroguard – Self Contained Delayed Egress
Mounting Fasteners	Supplied standard with machine screws
Top Bolt	Stainless steel
Device Centerline from Finished Floor	41" (1041mm) for Standard Applications 38" (965mm) for elementary schools
Door/Opening Height	**Must be specified** - 120" (3048mm) Max Door Opening 96" max door height for HC and WS options
Center Case Dimensions	8-3/8" (213mm) x 2-5/8" (67mm)
Projection	Pushbar Neutral – 3" (76mm) Pushbar Depressed – 2-1/8" (54mm)
Fire Exit Hardware	See Chart – Page 6

Note: MD8600 & 12-MD8600 can be used as NB- Device by simply not installing the bottom rod/bolt
Note: 12-NB Applications require thermal pin. Thermal Pin supplied when ordered as a 12-NB Device

100 Series Aux Control

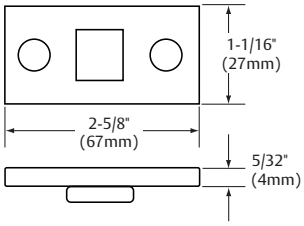
- Available as an 06 or 13 function
- Supplied with a SARGENT #41 Mortise Cylinder
- Can be used with any SARGENT Mortise Key System

650 Top Strike



- For application in hollow metal frames
- Stainless steel nylon coated

606 Bottom Strike



- Furnished with expansion shields
- Mortised into floor
- Stainless steel

MD8600 and NB-MD8600 Functions and Trims for Metal Doors

80 Series

SARGENT®
ASSA ABLOY

How to order:	Options	Series	Function	Rail Lgth	Trim	Hand	Outside Finish	Inside Finish	Door Width	Door Height	AFF
	57-NB-	MD86	13	F	ETL	RHR	03	03	36"	84"	41"

700 Series ET Trim

Exits with ET Trim, specify lever design after the ET designation (e.g., ETL)

Lever Designs for ET Controls

A, B, E, F, J, L, P, W
Also available with Coastal Series & Studio Collection Levers

ET Designation with Suffix (Used to order ET without device)

MD8600 & NB-MD8600 Series:
706-4, 710-4, 713-4, 715-4, 740-4, 743-4, 746-4, 773-4, & 774-4

Freewheeling Trim

The lever rotates when the door is locked preventing excessive force from being applied to the horizontal lever

Electrified ET Trim

Voltage must be specified for the following functions: 73 and 74. Specify: 12VDC or 24VDC

SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info (1-3/4" Door)	ANSI Type 8 MD8600 Panic & Fire
06	09	Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	MD8606 x ET_
10	01	No outside operation (No Cylinder)*	MD8610
10	02	No outside operation (No Cylinder)* ET Control is used as Pull Only	MD8610 x ET_
13	08	Key Outside Unlocks/locks Trim #41 Cylinder Supplied	MD8613 x ET_
15	14	Passage Only (No cylinder)	MD8615 x ET_
40	02	Freewheeling Trim - No outside Operation (No Cylinder)* Dummy Trim	MD8640 x ET_
43	08	Freewheeling Trim - Key Outside Unlocks/locks Trim #41 Cylinder Supplied	MD8643 x ET_
46	09	Freewheeling Trim - Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	MD8646 x ET_
73		Electrified ET Trim - Fail Safe Power Off, Unlocks Lever (No Cylinder)*	MD8673 x ET_
74		Electrified ET Trim - Fail Secure Power Off, Locks Lever (No Cylinder)*	MD8674 x ET_

Note: Exit devices are available in all standard finishes, except 14, 15, 26 & 26D. With these finishes, exit devices are supplied in 32 or 32D to match accordingly. 32 or 32D is automatically supplied when 26 or 26D is specified. For nickel finishes, specify 14/32 or 15/32D to receive nickel finished trims and stainless exit devices
Note: AFF means Above Finished Floor, center line of rail Above Finished Floor
* Cylinder Override is available with a 106 Aux Control
Example Order: MD8673F 12V x ETMG x 106 x RHR x 32D x 36"w x 84"h

100 Series Auxiliary Control* & 862 Pull

100 Series Aux. Control

862 Pull

SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info (1-3/4" Door)	MD8600 Panic & Fire
06	12	Key unlocks Turn, Turn retracts latch/ Turn relocks when key is removed #41 Cylinder Supplied	MD8610 x 106
10	02	862 Pull Only (Optional Pulls: 863 & 864)	MD8610 x 862 Pull
13	11	Key Outside Unlocks/locks Turn #41 Cylinder Supplied	MD8610 x 113

Note: When ordering MD8600/NB-MD8600 Series Exit Device x 100 Series Aux. Control, specify 10 Function for the exit.
Example: MD8610F x 106 x RHR x 32D x 42" x 90"

Options

MD8600

Mechanical Options:
12-
16-
19-
31-
36-
37-
43-
53-
54-
55-
56-
56-HK-
57-
58-
59-
5CH-
BC-59-
76-
85-
86-
87-
AL-
BT-
CPC-
HC-
LD-
NB-
PL-
* SG-
TL-
WS-

Cylinder Options:
10-
10-21-
10-63-
11-
11-21-
11-60-
11-63-
11-64-
11-70-7P-
11-72-7P-
11-73-7P-
11-65-73-7P-
21-
22-
51-
52-
60-
63-
64-
70-
72-
73-
65-73-
65-73-7P-
73-7P-
81-
82-
F1-82-
83-
F1-83-
84-
BR-
LC-
SC-
SE-

* Only available with 15, 26D and 32D finishes

Available Finishes

SARGENT Finishes	BHMA Finishes
03	605
04	606
09	611
10	612
10B	613
10BE	613E
10BL	614
14	618
15	619
20D	624
26	625
26D	626
32	629
32D	630
BSP	—
WSP	

Product Catalog

SARGENT
ASSA ABLOY

80 Series
Exit Device

ASSA ABLOY, the global leader
in door opening solutions

Windstorm Certifications

80 Series

SARGENT®
ASSA ABLOY

Windstorm Certifications: Florida Building Codes & UL Listings

SARGENT Manufacturing's products meet building codes that require hurricane, windstorm and FEMA certifications, including some of the most stringent building codes as specified in the Florida Building Code, Miami Dade Code and the International Building Code. Listed below are certifications and standards met by the 80 Series lock.

Florida Building Code: FL2998
UL Certification Directory: ZHEM.R21744 – Latching Hardware

ANSI/SDI-BHMA A250.13	"Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies"
ANSI/ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
(TAS) 201	"Impact Test Procedures"*
(TAS) 202	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
(TAS) 203	"Criteria for Testing Products Subject to Cyclic Wind Pressure Loading"*

* Published in the "Florida Building Code"

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

UL Certification Directory: ZHLL.R21744 – Products for Use in Windstorm-rated Assemblies

Certifications to meet assembly requirements are done in conjunction with doors from ASSA ABLOY Group companies CECO DOOR and CURRIES.

ASTM E330	"Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"
ANSI/ASTM E1886	"Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials"
ASTM E1996	"Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes"
AAMA/WDMA/CSA 101/I.S.2/A440	"Standard/Specification for Windows, Doors, and Unit Skylights"
FEMA Publication 320 (2014)	"Taking Shelter From the Storm: Building a Safe Room for Your Home or Small Business", investigated with respect to impact and pressure requirements only.
FEMA Publication 361 (2015)	"Design and Construction Guidance for Community Safe Rooms", investigated with respect to impact and pressure requirements only.
ICC 500 (2014)	"ICC/NSSA Standard for the Design and Construction of Storm Shelters", investigated with respect to impact and pressure testing. Minimum missile impact speeds vary with the design wind speed desired for a particular product. The information below correlates design wind speed to the minimum missile speeds as discussed in Table 305.1.1 of ICC 500

Any retrofit or other field modification to a fire rated opening can potentially impact the fire rating of the opening, and Sargent Manufacturing Company makes no representations or warranties concerning what such impact may be in any specific situation. When retrofitting any portion of an existing fire rated opening, or specifying and installing a new fire-rated opening, please consult with a code specialist or local code official (Authority Having Jurisdiction) to ensure compliance with all applicable codes and ratings.

SARGENT
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Cylinder Information for Exit Devices

Cylinder Chart: Exit Device Series x Function		ET Trim (700 Series Auxiliary Control)		PTB, PSB, STS, MAL, MSL, FLL, FSL, FLW, FSW	
	Door Thickness	1-3/4" (44mm)	2-1/4" (57mm)	1-3/4" (44mm)	2-1/4" (57mm)
Narrow Stile Mortise Exit Device	8304	46	48	41	43
	8313/8343	41	41	Not Available	
	8344	46	48	Not Available	
	8363	Not Available		41	43
	8375/8376	46	48	Not Available	
Narrow Stile CVR Exit Device	All 8400	41	41	Not Available	
Narrow Stile Rim Exit	8504	34	34	Not Available	
	8513/8543	41	41	Not Available	
Concealed Vertical Rod Exit Devices	All LP/LR/LS8600	41	Not Available		
	All SP/PP/PR8600	41		Not Available	
	All AD, MD & WD8600	41	41	Not Available	
Surface Vertical Rod Exit Devices	8706/8713/8743/8746	41	41	Not Available	
	8762/8763	Not Available		34	34
	All SP/PP/PR8700	41	N/A	Not Available	
Rim Exit Devices	8804	34	34	34	34
	8806/8813/8843/8846	41	41	Not Available	
	8816	34/*44	34/*44	Not Available	
	8844	34	34	Not Available	
	8863	Not Available		34	34
	8866	Not Available		34/*44	34/*44
	8875/8876/8877	34	34	Not Available	
Mortise Lock Exit Devices	8904	46	48	41	43
	8913/8943	41	41	Not Available	
	8916	*34/46	*34/48	Not Available	
	8944	46	48	Not Available	
	8963	Not Available		41	43
	8966	Not Available		*41/34	*43/34
	8975/8976	46	48	Not Available	

* Inside Cylinders
Chart shows cylinder type and size for conventional SARGENT cylinders.
Note: Cylinder sizes & types are limited, as noted: SC- & SE- cylinders are available in size 41
60-, 63- & 64- cylinders are available in sizes 42, 43, 44 & 46
70-, 11-70-, 72-, 11-72-, 73- & 11-73 cylinders are available in sizes 43 & 46
Note: The 8888's Lever & Rose Trim cylinder standard is the standard SARGENT 10 Line cylinder (13-3266)
Note: 41 Cylinder is 1-1/8" in length; For each additional digit, the cylinder is a 1/8" longer. Example: 42 is 1-1/4"; 43 is 1-3/8" and 46 is 1-3/4"
Note: SARGENT supplies standard blocking rings. Specify if using competitor cylinders

Mullions: Aluminum, Steel and Electrified

80 Series

SARGENT®
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Aluminum Mullions

Product Designation	650A	980	L980
Description	Removable	Removable	Lockable
Material	Aluminum	Aluminum	Aluminum
Standard Finish	US28/Satin Anodized Aluminum	Prime Coat	Aluminum Prime Coat
Options	Specify "650A x 10B" for 313AN to match 10B	Specify "980A" for Anodized US28/ Satin Aluminum	Specify: "L980A" Anodized Aluminum Specify: "L980A x10B" for 313AN to match 10B
Stk Size	96"	96"	96"
Max Stk Height	120"	120"	120"
Pre-prepped	658 Strikes Included	No	No
Cylinder Size	Not Required	Not Required	#41
Shape	1-1/2" x 2-1/2"	T Shaped 2-1/2" x 3"	T Shaped 2-1/2" x 3"
Misc. Information and Accessories	Includes 651 Stabilizers and imbedded Weather Stripping Top Retainer 94-2050 Bottom Retainer 94-2051	Top Retainer - 511 Bottom Retainer - 502 Adapter for narrow transom: 507 - Aluminum Prime Coated 507A - Anodized Aluminum	All Cylinder Options Available Wall Mount Kit 98-2578 Top Ret Pack 98-2526 Bottom Ret Pack 98-2525 Cylinder Kit 980C1*

Electrified

EL980
Electrical Lockable
Steel
Gray Paint
Wall Mounting Kit: 98-2580 Top Ret Pack :98-2559
96"
120"
No
#46 Only
Rectangular 2" x 3"
For use with Electric Strikes and Monitoring, Quick Connect Wiring Supplied Cylinder Kit 980C2*

***Note:** Cylinder Kits must be ordered separately

Steel Mullions

Product Designations	HC980	980S	L980S	HCL980	12-HD980
Description	Hurricane Code	Standard Mullion	Lockable	Lockable Hurricane Code	Heavy Duty
Material	Steel	Steel	Steel	Steel	Steel
Fire Rated	Specify 12-HC980	Specify 12-980	Specify 12-L980	Specify 12-HCL980	Specify 12-HD980
Fire Rated Max Height	96"	96"	96"	96"	120"
Finish	Gray Paint	Gray Paint	Gray Paint	Gray Paint	Gray Paint
Stk Size	96"	96"	96"	96"	120"
Max Stk Height	96"	120"	120"	96"	120"
Pre-prepped	No	No	No	No	No
Cylinder Size	Not Required	Not Required	#41 Std (#42 & #43 available)	#41 Std (#42 & #43 available)	Not Required
Shape	Rectangular 2' x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"	Rectangular 2" x 3"
Misc. Information	Designed for severe wind load conditions due to hurricanes or windstorms. Tested to Dade County Protocols & ASTM Standards	For 12-8800 - Channel Iron & Malleable iron top & bottom retainers.	Fire rated for 8'0" x 8'0" paired openings	See Notes Below	12-HD980 is for pair of doors over 8'0" to 10'0" for use with 2-8800 Rim Exits includes two piece strikes
Accessories	Top Ret Pack - 98-2599 Bottom Ret Pack - 98-2600 Top Retainer Shim Kit - 601	Top Ret Pack - 98-2190 Bottom Ret Pack - 98-2191 Top Retainer Shim Kit - 601	Wall Mounting Kit - 98-2579 Top Ret Pack - 98-2559 Bottom Ret Pack - 98-2556 Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	- Top Retainer Pack: 98-2593 - Bottom Retainer Pack: 98-2594 - Top Retainer Shim Kit - 601 Cylinder Kit - 980C1*	Top Ret Pack - 98-2599 ottom Ret Pack - 98-2600 op Retainer Shim Kit - 601

***Note:** Cylinder Kits must be ordered separately

Note for HC980/12-HC980 Mullions:

- Designed for severe wind load conditions due to hurricanes or tornadoes
- Tested to Dade County protocols and ANSI 250.13 ASTM Standards and FEMA 361
- 12- Fire labeled version
- Replacement lock kits are available for lockable mullions Part numbers for each model are listed in the price book

HCL980 Mullion Information

- Model 12-HC-L980 may be supplied for doors UL fire rated up to and including 3 hrs not exceeding 8 ft in width and height
- Meets the following standards: ANSI 250.13, ASTM E330, ASTM 1886, ASTM 1996, TAS 201, TAS 202 & TAS 203
- Designed for use with UL Classified HC8810, HC8800 and 12-HC8800 rim exit devices

Mullion Accessories and Stabilizers

80 Series

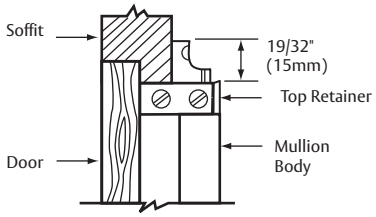
SARGENT
ASSA ABLOY

Mullion Accessories

RK980
Latchbolt assembly retrofit kit with top and bottom retainers for 980 aluminum mullion

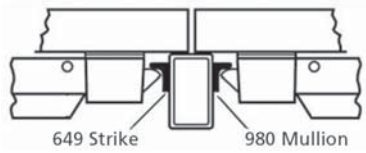
507 Narrow Transom Bars Adapter

- Available with 980 and 980A
- Required when soffit is 1-1/4" (32mm) to 2" (51mm) wide
- Order as a: 507 for 980 mullion or 507A for 980A mullion



980S Mullion Application

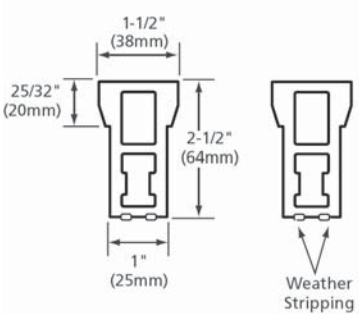
- All steel mullions are 2" x 3"



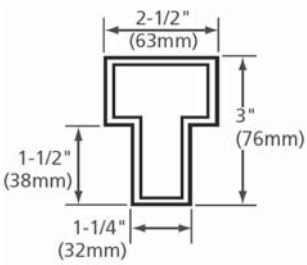
651 Mullion Stabilizer Kit

- Stabilizer block
- Furnished standard w/650A Mullion
- Order as a 651 Kit

650A Mullion



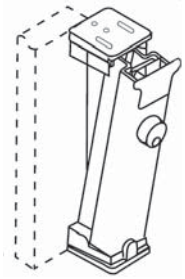
980 Mullion & L980 Lockable Mullion



980C1 Cylinder Mullion Kit

- Lockable mullions only
- Aluminum and steel
- Includes cylinder and collar
- Available in 26D & 10B finish

Lockable Mullion



Lockable Mullion Cylinder Kit Options*

L980, L980A, L980S & HC-L980 mullions are available with these options: 10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82-, F1-82-, 83-, F1-83-, 84-, SC- & SE-.

EL980 mullion is available with these options: 10, 10-21-, 10-63-, 11-, 11-21-, 11-60, 11-63-, 11-64-, 11-72-7P-, 11-65-73-7P-, 11-73-7P-, 21-, 22-, 60-, 63-, 64-, 70, 72-, 73-, 65-73-, 65-73-7P-, 73-7P-, 81-, 82- & F1-82-.

*Lockable mullions are shipped without cylinders. Order Cylinder Mullion Kit separately.

980C2 Cylinder Mullion Kit

- Lockable mullions
- Electrified only
- Includes cylinder and collar
- Available in 26D finish only

Mullion Weights & Packaging

Product	Avg Wt	Case
Exit Device with Trim	15 lbs	1 ea
980 Mullion	18 lbs	1 ea
12-980 Mullion	40 lbs	1 ea
650A Mullion	18 lbs	1 ea

Mechanical Options and Descriptions

80 Series

Mechanical Options:

Categories	How to Specify	Detailed Description
Fire Rated	**12-**	UL Fire Label Exit hardware (not available with 16- & HK-)
SVR Bolt	**14-**	Sliding bolt bottom case for 8700
Cylinder Dogging	**16-**	Cylinder lockdown with # 41 Cylinder & # 97 Ring (not available with 12-, 57, 59-, AL- or BT- Option)
	LD-	Less dogging for non fire rated devices
Less Touch Pad	**19-**	Pushbar without Lexan touchpad (not available TL-)
8900/8300 Strike	**23-**	4-7/8" (124mm) ANSI flat lip strike (for 8900 & 8300 Series Mortise Lock Exit Devices)
Thick Doors	**31-**	Doors over 1-3/4" and/or Panels (Specify door thickness, panel thickness & location as required) Not available for HC8700, FM8700, PP, PR & SP8700, PP, PR & SP8600, LP, LR & LP8700 Extended lip strike supplied for 8300 & 8900 Series
Security Fasteners	**36-**	Six lobe security head screws
	37-	Spanner head screws
Flush End cap	**43-**	Flush End Cap (Not available with LP, LR & LS Devices)
Indicator	**49-**	Indicator (Available on 8816 and 8866 functions only)
Electrical Options	**53-**	Latchbolt monitoring switch (not available with 59-, GL-, HC-, WS- or on FM8700, PP/PR/SP8600 & LP/LR/LS8600 Exit Devices)
	54-	Monitors ET Lever movement with Internal micro switch in ET Control
	55-	Request to Exit - Signal Switch in Rail (not available with 59- & FM8700)
	56-	Remote Latch Retraction (not available 57-, 58-, 59-, AL- or BT- Option)
	56-HK-	Remote Latch Retraction with manual Hex Key dogging (not available 12-, 57-, 58-, 59-, AL- or BT- Option)
	57-	Delayed Egress (Electromagnetic Lock required & purchased separately) (not available 16-, 53-, 56-, 56-HK, 58-, 59-, AL, Bc-59 - or BT, GL, TL Prefixes) (NB, 54- are available on request)
	58-	Electric Rail Dogging (Not available 56- & 59-)
	59-	Electroguard® Self Contained Delayed Egress Device (not available with 16-, 53-, 55-, 56-, 57-, 58-, AL-, BT-, GL-, HC- & WS Option Prefixes, PP/PR/SP8600, LP/LR/LS8600 Exit Devices) (NB, 54- are available upon request)
	AL-	Alarmed Exit (Not available 16-, 56-, 57-, 59-, BT-, GL-, HC- & WS-)
	BC-59-	Electroguard® Boca Code (Door Status Switch required) (not available with 16-, 55-, 56-, 57-, 58-, AL-, BT-, GL-, HC- & WS-Options and on NB8700, PP/PR/SP8600 & LP/LR/LS8600 Exit Devices)
	TL-	SARGuide Electro-Luminescent Touchpad (not available 19-, 85-, 87- & PL-)
Tactile Warning Options	**76-**	Tactile Warning - Milled Outside Lever (not available with Studio & Coastal Levers and the A Lever)
	85-	Tactile Warning - Abrasive strip on Push Rail (Not available with PL- & TL-)
	86-	Tactile Warning - Abrasive coating on Outside Lever
	87-	Tactile Warning - Abrasive strip on Push Rail & Abrasive coating on Outside Lever (not available with PL- & TL-)
Finish Protection	**CPC-**	Clear Powder Coat (Available for 32 & 32D Finishes)
	SG-	MicroShield® antimicrobial clear powder coat (only available with 15, 26D and 32D finishes)
Top Rod Only	**NB-**	Less Bottom Rod & Bolt (for SVR & CVR Devices)
Guarded Latch	**GL-**	Guarded Latch for Rim Exit Devices (not available 53-, 56-, 59-, AL-, HC- & WS-)
SARGuide	**PL-**	SARGuide™ PL – Photoluminescent Coated Push Rail – (Touchpad eliminated) (not available 85, 87 & TL-)
Through Bolts	**TB-**	Through Bolts for 8300, 8500, 8600, 8700, 8800 & 8900 Devices
Rail Force	**5CH-**	5lb. Pressure Release (8800 only)

SARGENT®
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Cylinder Options and Descriptions

80 Series

Cylinder Options:

Conventional Cylinder	-	SARGENT Conventional Cylinders Supplied Standard (Unless Otherwise Specified)
Degree Key System	**DG1-**	SARGENT Degree Key System Level 1 (bump resistant with patented keys)
	DG1-21-	Degree Level 1 Construction Master Keying
	DG1-60-	Degree Level 1 Removable Disposable Construction Core
	DG1-63-	Degree Level 1 Removable Core
	DG1-64-	Degree Level 1 Removable Construction Keyed LFIC
	DG1-65-	Degree Level 1 Unassembled/Uncombined Core
	DG2-	SARGENT Degree Key System Level 2 (geographically exclusive; bump and pick resistant)
	DG2-21-	Degree Level 2 Construction Master Keying
	DG2-60-	Degree Level 2 Removable Disposable Construction Core
	DG2-63-	Degree Level 2 Removable Core
	DG2-64-	Degree Level 2 Removable Construction Keyed LFIC
	DG2-65-	Degree Level 2 Unassembled/Uncombined Core
	DG3-	SARGENT Degree Key System Level 3 (geographically exclusive; UL437 certified; bump and pick resistant)
	DG3-21-	Degree Level 3 Construction Master Keying
	DG3-60-	Degree Level 3 Removable Disposable Construction Core
	DG3-63-	Degree Level 3 Removable Core
	DG3-64-	Degree Level 3 Removable Construction Keyed LFIC
	DG3-65	Degree Level 3 Unassembled/Uncombined Core
Signature Key System	**10-**	SARGENT Signature Key System (Not Available with other Key Systems)
	10-21-	SARGENT Signature Construction Key System (Lost Ball)
Signature- LFIC	**10-63-**	SARGENT Signature Large Format Interchangeable Core Cylinder (Removable)
XC- Key System	**11-**	XC Key System (Not available with other Key systems unless specified)
	11-21-	XC- Construction Key System (Lost Ball)
XC- Large Format Interchangeable Core (Removable Core)	**11-60-**	Device to accept XC- Permanent Large Format Interchangeable Core, Disposable plastic Core- provided
	11-63-	Device provided with XC- Large Format Interchangeable Core Cylinder - (Includes masterkeying, grand masterkeying)
	11-64-	Device provided with Keyed construction core to accept XC- Permanent Large Format Interchangeable Core (ordered separately)
XC- Small Format Interchangeable Core	**11-70-7P-**	Device to accept XC- SFIC (7-Pin) XC- Permanent Cores, plastic disposable core provided
	11-72-7P-	Device to accept XC- SFIC (7-Pin Keyed Construction Core provided) cylinder Permanent core ordered separately
	11-73-7P-	Device provided with XC- Small Format 7-Pin interchangeable core (Includes masterkeying, grand masterkeying)
	11-65-73-7P-	Device provided to accept XC- Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose)
Construction Key Systems	**21-**	SARGENT Lost Ball Construction Keying for Conventional, XC and Signature Series (N/A with 63- or 73-)
	22-	SARGENT Construction Split Key System for Conventional Cylinders (Existing Systems Only) (N/A with 10-, 11-, 63- or 73-)
Old Style Removable Core	**51-**	Removable Core Cylinder (Old Style) provided (existing systems only)
	52-	Removable Construction Core (Old Style) Permanent core ordered separately (existing systems only)
Large Format Interchangeable Core (Removable Core)	**60-**	Device to accept SARGENT Permanent Large Format Interchangeable Core, Disposable plastic Core provided (Permanent Cores ordered separately)
	63-	Device provided with Large Format Interchangeable Core Cylinder - (Includes masterkeying, grand masterkeying)
	64-	Device provided with Keyed construction core to accept Permanent Large Format Interchangeable Core (ordered separately)
Small Format Interchangeable Core	**70-**	Device to accept 6- or 7-Pin SFIC Permanent Cores, plastic disposable core provided
	72-	Device to accept 6- or 7-Pin SFIC (6-Pin Keyed Construction Core provided) Cylinder (Permanent Core ordered separately)
	73-	Device provided with 6-Pin SFIC (Includes masterkeying, grand masterkeying)
	65-73-	Device provided to accept Uncombinated 6-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	65-73-7P-	Device provided to accept Uncombinated 7-Pin SFIC (Permanent) Core - (Packed Loose for field keying)
	73-7P-	Device provided with Small Format 7-Pin Interchangeable Core (Includes masterkeying, grand masterkeying)
Keso & Keso F1	**81-**	Device provided with housings to accept Keso (83) & Keso F1 (F1-83-) removable cores. (Permanent Cores ordered separately)
	82-	Device provided with SARGENT Keso Security Cylinder
	F1-82-	Device provided with SARGENT Keso F1 Security Cylinder (Patented)
	83-	Device provided with SARGENT Keso Security Removable Core cylinder
	F1-83-	Device provided with SARGENT Keso F1 Security Removable Core cylinder (Patented)
	84-	Device provided with SARGENT Keso Construction Cores (Permanent Cores ordered separately)
Added Security	**BR-**	Bump Resistant Cylinder (Available with Conventional & Conventional XC Cylinders Only)
Less Cylinder	**LC-**	Less Cylinder - SARGENT supplies standard blocking rings for 1-1/8" Cylinders (For longer cylinders order collars/rings separately)
Schlage Keyways	**SC-**	Schlage C keyway cylinder, 0 bitted (not available with: 8904, 8916, 8944, 8975, 8976, 8866, 8304, 8344, 8375 & 8376)
	SE-	Schlage E keyway cylinder, 0 bitted (not available with: 8904, 8916, 8944, 8975, 8976, 8866, 8304, 8344, 8375 & 8376)
Lever to Accept Schlage	**SF-**	L Lever to accept MEDECO KeyMark Large Format Interchangeable and Schlage Full Size Interchangeable Core (Supplied Less Cylinder, but with tailpiece needed) (Available for 88-KLL & 88-CLL)

Note: For V-10 Cylinders and information, contact ASSA

8800 Rim Exit Device

80 Series

SARGENT®
ASSA ABLOY

8800 Series
Rim Exit Device

8800 Features

- Designed for standard width stile applications on wood and metal doors
- Also available as an HC8800 or WS8800 for hurricane-resistant applications, see Hurricane-Resistant section of this catalog
- Single point rim latching device
- Single door & double door applications with mullions
- Quiet operation and solid security
- ANSI/BHMA A156.3 - Grade 1
- UL10C (Fire) and UL305 (Panic) Listed

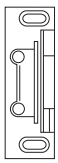
Specifications — 8800 Series Rim Exit Device

Door Type	Metal Doors
Door Thickness	1-3/4" (44mm) minimum thickness. For doors over 1-3/4" to 2 1/4" thick, specify thickness and order as 31-
Rail sizes as determined by door width	Rails are available in 4 sizes, use door width to determine size needed. Rails will be factory cut to size, if door width is supplied • E Rail for 24" to 32" door widths, No cutting required for 32" door • F Rail for 33" to 36" door widths, No cutting required for 36" door • J Rail for 37" to 42" door widths, No cutting required for 42" door • G Rail for 43" to 48" door widths, No cutting required for 48" door
Strike	649 Standard Black Nylon Coated
Optional Strikes	642, 644 and 613
Dogging Feature	Hex key dogging standard on non fired rated devices; specify 16- for cylinder dogging (#41 cylinder supplied)
Electric Options	AL- Alarm PL- SARGuide Photoluminescent Coated TL- SARGuide Illuminated Touchpad
	49- Indicator 53- LX Latchbolt Monitor 54- Outside Lever Monitoring 55- Request-to-Exit Signal - Rail Monitoring 56- Remote Latch Retraction 57- Delay Egress & Electromagnets 58- Electric Dogging 59- Electroguard – Self Contained Delayed Egress
Mounting Fasteners	Supplied standard with wood and machine screws Available with through-bolts and mortise (sex) nuts
Latch Bolt	Stainless steel, 3/4" (19mm) throw
Device Centerline from Finished Floor	41" (1041 mm) for Standard Applications
Center Case Dimensions	8-3/8" (213mm) x 2-5/8" (67mm)
Projection	Pushbar Neutral – 3" (76 mm) Pushbar Depressed – 2-1/8" (54 mm)
Fire Exit Hardware	See Chart – Page 6

49- Lock/Unlock Indicator Option

- Displays whether the door has been secured by the inside cylinder.
- Red icon indicates locked
- White icon indicates unlocked
- Dogging overrides 49- functionality (must order less dogging)
- Available on 8816 and 8866 functions only

649 Strike



- Supplied standard for panic & fire rated openings
- Surface applied
- Black nylon coated

688 Trim Retrofit Kit

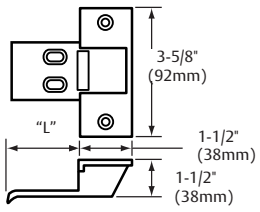
- 688 Trim Retrofit kit allows an 8800* Series rim exit with an ET to replace Von Duprin's 98/99 Series exit with trim with minimal door prep.

* Except for 16 function

- Order as: 688 Kit

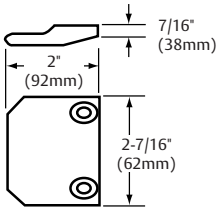
Alternate Strikes For 8800 Rim Devices

642 Strike



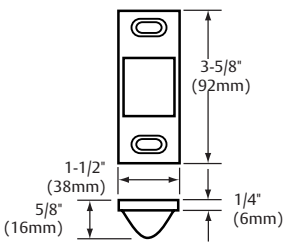
- Mortised. Dimension "L" equals door thickness plus 1/2" (13mm). Black nylon coated on lip only

644 Strike



- Surface applied. For use on pairs of doors without mullion. Ductile Iron. Black nylon coated

613 Strike



- Half mortised. Black nylon coated

SARGENT®
ASSA ABLOY

8800 Functions and Trims

80 Series

Options	Series	Function	Rail Lgth	Trim	Hand	Outside Finish	Inside Finish	Door Width
F1-83-56	88	13	F	ETL	RHR	26D	32D	36"

700 Series ET Trim

Exits with ET Trim, specify lever design after the ET designation (e.g., ETL)

Lever Designs for ET Controls

A, B, E, F, J, L, P, W

Also available with Coastal Series & Studio Collection Levers

ET Designation with Suffix (Used to order ET without device)

8800 Series: 704, 706-8, 710, 713-8, 715-8, 716, 740, 743-8, 744, 746-8, 773-8, 774-8, 775-8 & 776-8

Freewheeling Trim

The lever rotates when the door is locked preventing excessive force from being applied to the horizontal lever

Electrified ET Trim

Voltage must be specified for the following functions: 73, 74, 75 and 76. Specify: 12VDC or 24VDC

SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info (1-3/4" Door)	ANSI Type 1 8800 Panic & Fire
04	03	Night Latch Key Retracts Latch #34 Cylinder Supplied	8804 x ET_
06	09	Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	8806 x ET_
10	01	No outside operation (No Cylinder)	8810
10	02	No outside operation (No Cylinder) ET Control is used as Pull Only	8810 x ET_
13	08	Key Outside Unlocks/locks Trim #41 Cylinder Supplied	8813 x ET_
15	14	Passage Only (No cylinder)	8815 x ET_
16	10	Key Outside Retracts Latch; Key Inside Unlocks/Locks O/S Trim O/S #34 Cylinder & I/S #44 Cylinder Supplied	8816 x ET_
40	02	Freewheeling Trim - No outside operation (No Cylinder) Dummy Trim	8840 x ET_
43	08	Freewheeling Trim - Key Outside Unlocks/locks Trim #41 Cylinder Supplied	8843 x ET_
44	03	Freewheeling Trim - Key Retracts Latch #34 Cylinder Supplied	8844 x ET_
46	09	Freewheeling Trim - Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	8846 x ET_
73		Electrified ET Trim - Fail Safe Power Off, Unlocks Lever (No Cylinder)	8873 x ET_
74		Electrified ET Trim - Fail Secure Power Off, Locks Lever (No Cylinder)	8874 x ET_
75		Electrified ET Trim - Fail Safe Power Off, Unlocks Lever, Key Retracts Latch #34 Cylinder Supplied	8875 x ET_
76		Electrified ET Trim - Fail Secure Power Off, Locks Lever, Key Retracts Latch #34 Cylinder Supplied	8876 x ET_

Note: Exit devices are available in all standard finishes, except 14, 15, 26 & 26D. With these finishes, exit devices are supplied in 32 or 32D to match accordingly. 32 or 32D is automatically supplied when 26 or 26D is specified. For nickel finishes, specify 14/32 or 15/32D to receive nickel finished trims and stainless exit devices

Options

8800

Mechanical Options:
12-
16-
19-
31-
36-
37-
43-
53-
54-
55-
56-
56-HK-
57-
58-
59-
5CH-
BC-59-
76-
85-
86-
87-
AL-
BT-
CPC-
GL-
LD-
PL-
** SG-
TB-
TL-

Cylinder Options:
10-
10-21-
10-63-
11-
11-21-
11-60-
11-63-
11-64-
11-70-7P-
11-72-7P-
11-73-7P-
11-65-73-7P-
21-
22-
51-
52-
60-
63-
64-
70-
72-
73-
65-73-
65-73-7P-
73-7P-
81-
82-
F1-82-
83-
F1-83-
84-
BR-
LC-
*SC-
*SE-

* Options are not available with 8816
** Only available with 15, 26D and 32D finishes

Pull & Thumbpiece Trim Section

Trim Designations

- Use three letter designations (Ex "PTB") when ordering the Exit Device with trim
- Use the six digit designation (Ex "866-MAL") when ordering trim without an Exit Device, always specify finish

Series

8800
Panic & Fire

SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info. (1-3/4" Door)							
04	03	Night Latch Key Retracts Latch #34 Cylinder Supplied	814-FSL*	814-FSW*	814-MSL*	814-PSB*	814-STS	862 Pull	8804 x Trim Designation
10	02	No O/S Operation or Cylinder (Pull Only)	810-FLL	810-FLW	810-MAL	810-PTB	810-STS	862 Pull	8810 x Trim Designation
28	15	Passage Only (No cylinder)	828-FLL	828-FLW	828-MAL	828-PTB	828-STS	N/A	8828 x Trim Designation
63	05	Key Outside Unlocks/ Locks Thumbpiece #34 Cylinder Supplied	866-FLL	866-FLW	866-MAL	866-PTB	866-STS	N/A	8863 x Trim Designation
66	07	Key Outside Retracts Latch; Key Inside Unlocks/Locks O/S Trim O/S #34 & I/S #44	866-FLL	866-FLW	866-MAL	866-PTB	866-STS	N/A	8866 x Trim Designation

* FSL, FSW, MSL and PSB trims are used with (HC-& 12-) 8888 and 8804 only and are the same as FLL, FLW, MAL and PTB pulls except for cylinder hole located 3/8" (9mm) lower.
Note: Thumbpiece trims for 63 and 66 function devices are identical and are identified as 66 function when trim is ordered separately.
Note: FLW & FSW trims are not available in 32(629) or 32D(630).
Note: Pulls and thumb piece trims are not available in 14, 15, 26 or 26D.

Available Finishes

SARGENT Finishes	BHMA Finishes
03	605
04	606
09	611
10	612
10B	613
10BE	613E
10BL	614
14	618
15	619
20D	624
26	625
26D	626
32	629
32D	630
BSP	—
WSP	

ET Trim, Levers and Pulls

80 Series

SARGENT®
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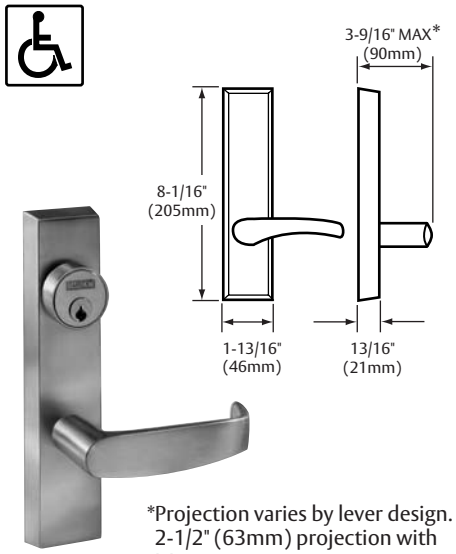
ET Lever Controls

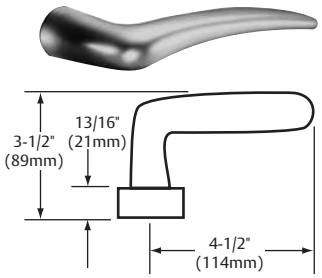


*Projection varies by lever design. 2-1/2" (63mm) projection with L Lever

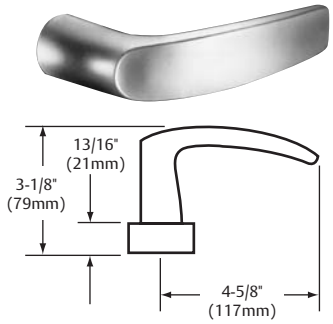
Note: ET suffixes required when ordering ET trim without an exit device, see page 74 for complete details

A Lever

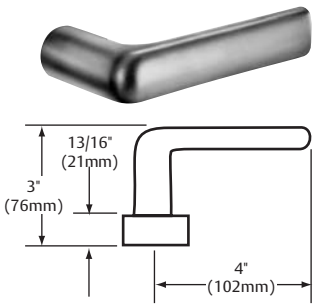
- Handed



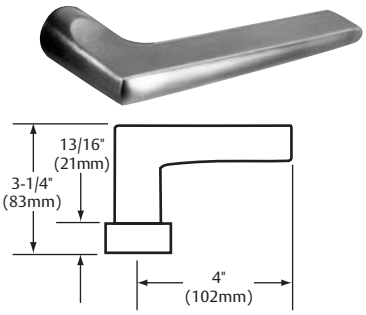
B Lever



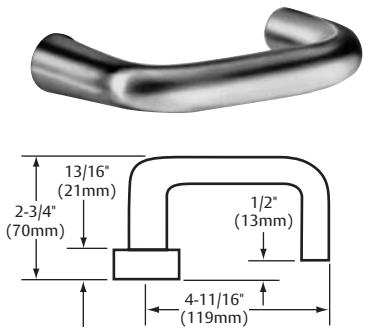
E Lever



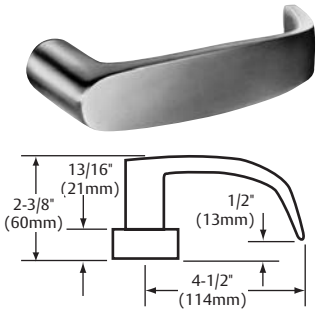
F Lever



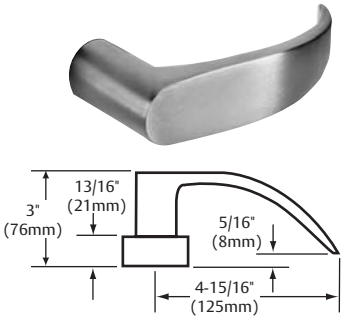
J Lever*



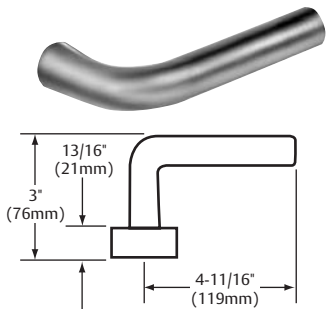
L Lever*



P Lever*

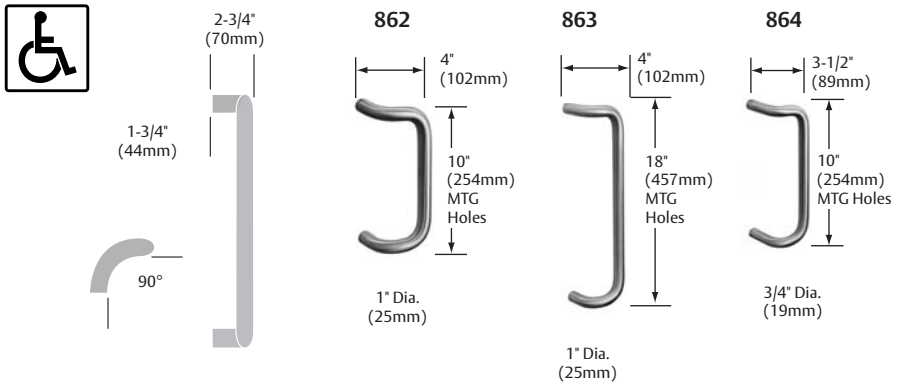


W Lever



* Lever returns within 1/2" (13mm) of door face

Pulls



8800 Rim Exit Device

80 Series

SARGENT®
ASSA ABLOY

8800 Series
Rim Exit Device

8800 Features

- Designed for standard width stile applications on wood and metal doors
- Also available as an HC8800 or WS8800 for hurricane-resistant applications, see Hurricane-Resistant section of this catalog
- Single point rim latching device
- Single door & double door applications with mullions
- Quiet operation and solid security
- ANSI/BHMA A156.3 - Grade 1
- UL10C (Fire) and UL305 (Panic) Listed

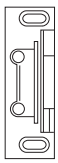
Specifications — 8800 Series Rim Exit Device

Door Type	Metal Doors
Door Thickness	1-3/4" (44mm) minimum thickness. For doors over 1-3/4" to 2 1/4" thick, specify thickness and order as 31-
Rail sizes as determined by door width	Rails are available in 4 sizes, use door width to determine size needed. Rails will be factory cut to size, if door width is supplied • E Rail for 24" to 32" door widths, No cutting required for 32" door • F Rail for 33" to 36" door widths, No cutting required for 36" door • J Rail for 37" to 42" door widths, No cutting required for 42" door • G Rail for 43" to 48" door widths, No cutting required for 48" door
Strike	649 Standard Black Nylon Coated
Optional Strikes	642, 644 and 613
Dogging Feature	Hex key dogging standard on non fired rated devices; specify 16- for cylinder dogging (#41 cylinder supplied)
Electric Options	AL- Alarm PL- SARGuide Photoluminescent Coated TL- SARGuide Illuminated Touchpad
	49- Indicator 53- LX Latchbolt Monitor 54- Outside Lever Monitoring 55- Request-to-Exit Signal - Rail Monitoring 56- Remote Latch Retraction 57- Delay Egress & Electromagnets 58- Electric Dogging 59- Electroguard – Self Contained Delayed Egress
Mounting Fasteners	Supplied standard with wood and machine screws Available with through-bolts and mortise (sex) nuts
Latch Bolt	Stainless steel, 3/4" (19mm) throw
Device Centerline from Finished Floor	41" (1041 mm) for Standard Applications
Center Case Dimensions	8-3/8" (213mm) x 2-5/8" (67mm)
Projection	Pushbar Neutral – 3" (76 mm) Pushbar Depressed – 2-1/8" (54 mm)
Fire Exit Hardware	See Chart – Page 6

49- Lock/Unlock Indicator Option

- Displays whether the door has been secured by the inside cylinder.
- Red icon indicates locked
- White icon indicates unlocked
- Dogging overrides 49- functionality (must order less dogging)
- Available on 8816 and 8866 functions only

649 Strike



- Supplied standard for panic & fire rated openings
- Surface applied
- Black nylon coated

688 Trim Retrofit Kit

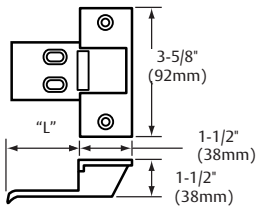
- 688 Trim Retrofit kit allows an 8800* Series rim exit with an ET to replace Von Duprin's 98/99 Series exit with trim with minimal door prep.

* Except for 16 function

- Order as: 688 Kit

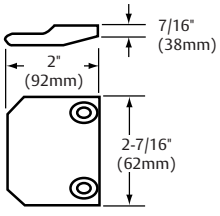
Alternate Strikes For 8800 Rim Devices

642 Strike



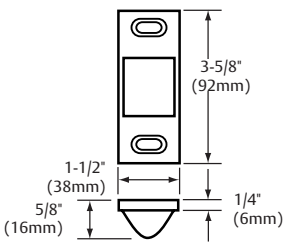
- Mortised. Dimension "L" equals door thickness plus 1/2" (13mm). Black nylon coated on lip only

644 Strike



- Surface applied. For use on pairs of doors without mullion. Ductile Iron. Black nylon coated

613 Strike



- Half mortised. Black nylon coated

SARGENT®
ASSA ABLOY

8800 Functions and Trims

80 Series

Options	Series	Function	Rail Lgth	Trim	Hand	Outside Finish	Inside Finish	Door Width
F1-83-56	88	13	F	ETL	RHR	26D	32D	36"

700 Series ET Trim

Exits with ET Trim, specify lever design after the ET designation (e.g., ETL)

Lever Designs for ET Controls

A, B, E, F, J, L, P, W

Also available with Coastal Series & Studio Collection Levers

ET Designation with Suffix (Used to order ET without device)

8800 Series: 704, 706-8, 710, 713-8, 715-8, 716, 740, 743-8, 744, 746-8, 773-8, 774-8, 775-8 & 776-8

Freewheeling Trim

The lever rotates when the door is locked preventing excessive force from being applied to the horizontal lever

Electrified ET Trim

Voltage must be specified for the following functions: 73, 74, 75 and 76. Specify: 12VDC or 24VDC

SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info (1-3/4" Door)	ANSI Type 1 8800 Panic & Fire
04	03	Night Latch Key Retracts Latch #34 Cylinder Supplied	8804 x ET_
06	09	Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	8806 x ET_
10	01	No outside operation (No Cylinder)	8810
10	02	No outside operation (No Cylinder) ET Control is used as Pull Only	8810 x ET_
13	08	Key Outside Unlocks/locks Trim #41 Cylinder Supplied	8813 x ET_
15	14	Passage Only (No cylinder)	8815 x ET_
16	10	Key Outside Retracts Latch; Key Inside Unlocks/Locks O/S Trim O/S #34 Cylinder & I/S #44 Cylinder Supplied	8816 x ET_
40	02	Freewheeling Trim - No outside operation (No Cylinder) Dummy Trim	8840 x ET_
43	08	Freewheeling Trim - Key Outside Unlocks/locks Trim #41 Cylinder Supplied	8843 x ET_
44	03	Freewheeling Trim - Key Retracts Latch #34 Cylinder Supplied	8844 x ET_
46	09	Freewheeling Trim - Key unlocks Trim, Trim retracts latch/ Trim relocks when key is removed #41 Cylinder Supplied	8846 x ET_
73		Electrified ET Trim - Fail Safe Power Off, Unlocks Lever (No Cylinder)	8873 x ET_
74		Electrified ET Trim - Fail Secure Power Off, Locks Lever (No Cylinder)	8874 x ET_
75		Electrified ET Trim - Fail Safe Power Off, Unlocks Lever, Key Retracts Latch #34 Cylinder Supplied	8875 x ET_
76		Electrified ET Trim - Fail Secure Power Off, Locks Lever, Key Retracts Latch #34 Cylinder Supplied	8876 x ET_

Note: Exit devices are available in all standard finishes, except 14, 15, 26 & 26D. With these finishes, exit devices are supplied in 32 or 32D to match accordingly. 32 or 32D is automatically supplied when 26 or 26D is specified. For nickel finishes, specify 14/32 or 15/32D to receive nickel finished trims and stainless exit devices

Options

8800

Mechanical Options:
12-
16-
19-
31-
36-
37-
43-
53-
54-
55-
56-
56-HK-
57-
58-
59-
5CH-
BC-59-
76-
85-
86-
87-
AL-
BT-
CPC-
GL-
LD-
PL-
** SG-
TB-
TL-

Cylinder Options:
10-
10-21-
10-63-
11-
11-21-
11-60-
11-63-
11-64-
11-70-7P-
11-72-7P-
11-73-7P-
11-65-73-7P-
21-
22-
51-
52-
60-
63-
64-
70-
72-
73-
65-73-
65-73-7P-
73-7P-
81-
82-
F1-82-
83-
F1-83-
84-
BR-
LC-
*SC-
*SE-

* Options are not available with 8816
** Only available with 15, 26D and 32D finishes

Pull & Thumbpiece Trim Section

Trim Designations

- Use three letter designations (Ex "PTB") when ordering the Exit Device with trim
- Use the six digit designation (Ex "866-MAL") when ordering trim without an Exit Device, always specify finish

Series

8800
Panic & Fire

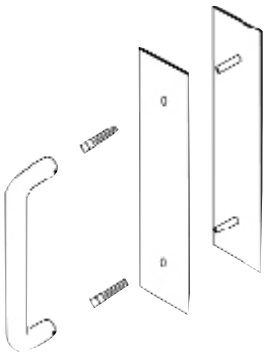
SARGENT Function Numbers	ANSI Function Numbers	Description & Cylinder Info. (1-3/4" Door)							
04	03	Night Latch Key Retracts Latch #34 Cylinder Supplied	814-FSL*	814-FSW*	814-MSL*	814-PSB*	814-STS	862 Pull	8804 x Trim Designation
10	02	No O/S Operation or Cylinder (Pull Only)	810-FLL	810-FLW	810-MAL	810-PTB	810-STS	862 Pull	8810 x Trim Designation
28	15	Passage Only (No cylinder)	828-FLL	828-FLW	828-MAL	828-PTB	828-STS	N/A	8828 x Trim Designation
63	05	Key Outside Unlocks/ Locks Thumbpiece #34 Cylinder Supplied	866-FLL	866-FLW	866-MAL	866-PTB	866-STS	N/A	8863 x Trim Designation
66	07	Key Outside Retracts Latch; Key Inside Unlocks/Locks O/S Trim O/S #34 & I/S #44	866-FLL	866-FLW	866-MAL	866-PTB	866-STS	N/A	8866 x Trim Designation

* FSL, FSW, MSL and PSB trims are used with (HC-& 12-) 8888 and 8804 only and are the same as FLL, FLW, MAL and PTB pulls except for cylinder hole located 3/8" (9mm) lower.
Note: Thumbpiece trims for 63 and 66 function devices are identical and are identified as 66 function when trim is ordered separately.
Note: FLW & FSW trims are not available in 32(629) or 32D(630).
Note: Pulls and thumb piece trims are not available in 14, 15, 26 or 26D.

Available Finishes

SARGENT Finishes	BHMA Finishes
03	605
04	606
09	611
10	612
10B	613
10BE	613E
10BL	614
14	618
15	619
20D	624
26	625
26D	626
32	629
32D	630
BSP	—
WSP	

Received
By PCM3 at 12:54 pm, April 27, 2023



Concealed Mount Pull Plate Sets
No. 107 x 73B/73BL, 110 x 73C/73CL, 111 x 73C/73CL

Material: Stainless steel

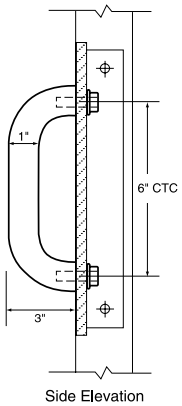
Finishes: US32D

Fastener: Type 9. Stud welded lugs on the back of the push plate are permanently attached to the 1/8" thick push plate. Cone head MS attached to selected door pull

Features:
- This set has no perimeter screw holes in either plate
- Concealed mounting system. Any of the rod type door pulls from No. 105 to No. 118 are appropriate for this application

Options:
- Engraving on plates 4" wide or wider. Specify copy. See page B1 for standard engraving locations
- Cylinder cutouts (CFC) and turn knob cutouts (CFTT). See page B1 for standard locations and sizes
- *Other overall sizes available upon request

No.	Pull	Pull Size	Pull CTC	Pull Plate	Push Plate	Overall*	Weight	ANSI A156.6
107 x 73B/73BL	107	3/4" dia.	8"	73B	73BL	3 1/2" x 15"	5.8 lbs.	J406
110 x 73C/73CL	110	1" dia.	8"	73C	73CL	4" x 16"	8.0 lbs.	J406
111 x 73C/73CL	111	1" dia.	10"	73C	73CL	4" x 16"	8.5 lbs.	J406



Side Elevation

Security Door Pull No. 110-6SP

Material: Stainless steel

Finishes: US32D

Fastener: 3/8 - 16 hex head MS with nylon patch

Features: For use on security hollow metal doors with reinforcing plate and access hole cover plate with TORX - security Torx screws — all to be supplied by door manufacturer

No.	Material Size	CTC	Overall	Base	Projection	Clearance	Weight	ANSI A156.6
110-6SP	1" dia.	6"	7"	1"	3"	2"	2.4 lbs.	J401

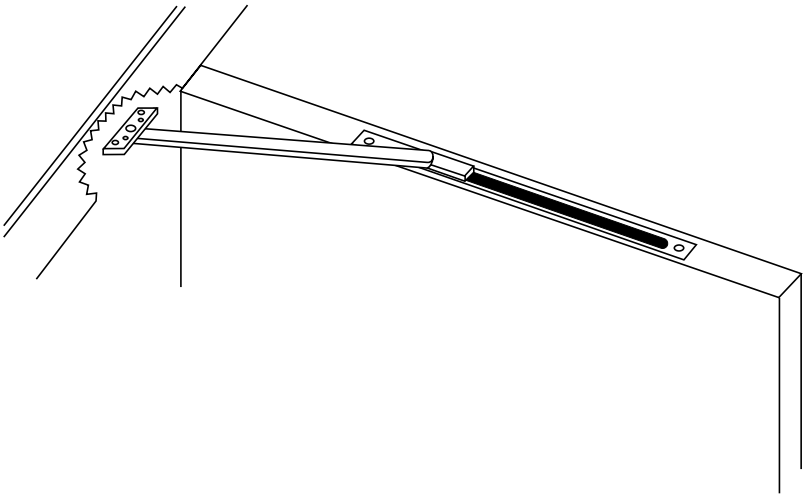
RIXSON®
ASSA ABLOY

Checkmate® Stops and Holders
Heavy-Duty 1 Series

Concealed Mount – Interior or Exterior – High Traffic Doors

Product Description & Features

- Doors may be single or double acting
- Non-handed
- Slide track design
- Recommended for high traffic, heavy abuse installations
- Heavy shock absorber spring provides 5 -7° compression before dead stop
- LS option omits spring for special applications
- Surface on/off knob on hold open models
- Stop, friction stay or hold open functions
- Complete screw packet for installation in wood and machine screws for door and frame.
- For security areas, Torx® screws available for exposed fasteners
- Standard architectural finishes
- Durable slider cam and shock block
- 110° maximum opening
- 1-3/4" minimum door thickness, for thicker doors, note thickness when ordering
- 1-3/16" square channel
- Stop function UL listed for fire door assemblies
- Hanging means other than standard butts or offset pivots require special templating and pricing. Consult factory



Door Opening Chart (*in inches*)

Butts Offset Pivots	Center Hung Pivots	Model Number		
		Friction	H.O.	Stop
*24 - 28	—	1-116	1-126	1-136
28-1/16 - 33	30 - 36	1-216	1-226	1-236
33-1/16 - 38	36-1/16 - 41	1-316	1-326	1-336
38-1/16 - 43	41-1/16 - 46	1-416	1-426	1-436
43-1/16 - 48	46-1/16 - 50	1-516	1-526	1-536

**Butt hung only on this size door. No swing clear hinges.*

	ANSI No.		
Shipping Weight 4.5 lbs.	Friction	H.O.	Stop
	CO1531	C01511	C01541

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Checkmate® Stops and Holders Options, Certifications, Limited Warranty, Specifications

Options

Less Spring – Suffix LS

Heavy duty slide track type stops have a spring in the end of the channel that keeps the slider from deadstopping. If these units are being used with electromechanical closer, where the door must deadstop, the LS option is needed. For non-adjustable models 1 and 9 only.

Angle Jamb Bracket Adapter –
Standard-duty models suffix 5258 (non-handed)
Heavy-duty models suffix 5458 (LH) or 5459 (RH)

When surface mounted units are mounted on a rabbeted door on the push side, flush door and transom on the push side, or in a reverse installation on the pull side of the door a special bracket is needed. Note that not all models can be mounted on the pull side of the door (*See specific model numbers in catalog.*)

5258

5458

Security Screws – Suffix Torx

Security screws can be supplied for exposed fasteners.

Certifications

All Rixson Checkmate® overhead stops and holders are in compliance with ANSI/BHMA 156.8, Grade 1 and 2 Standards. See individual products for sub sections. See individual models for UL Listing.

Limited Warranty

Rixson Checkmate® stops and holders are warranted for 2 years for defect. See *Rixson* price book for specific details of the limited warranty

Specifications

All overhead stops and holders shall be from a single manufacturer.

Standard-duty models used for interior or low to medium traffic doors.

Heavy-duty models used for exterior or high traffic doors or doors subject to abuse.

For extremely abusive areas or high winds use double lever arm type.

Coordinate deadstop and/or hold open location with concealed floor closers.

Checkmate products provide hold open and/or deadstop.

Product Catalog

SARGENT
ASSA ABLOY

351 Series
Powerglide® Door Closer

Experience a safer
and more open world

Features and Benefits

351 Series Powerglide®

SARGENT
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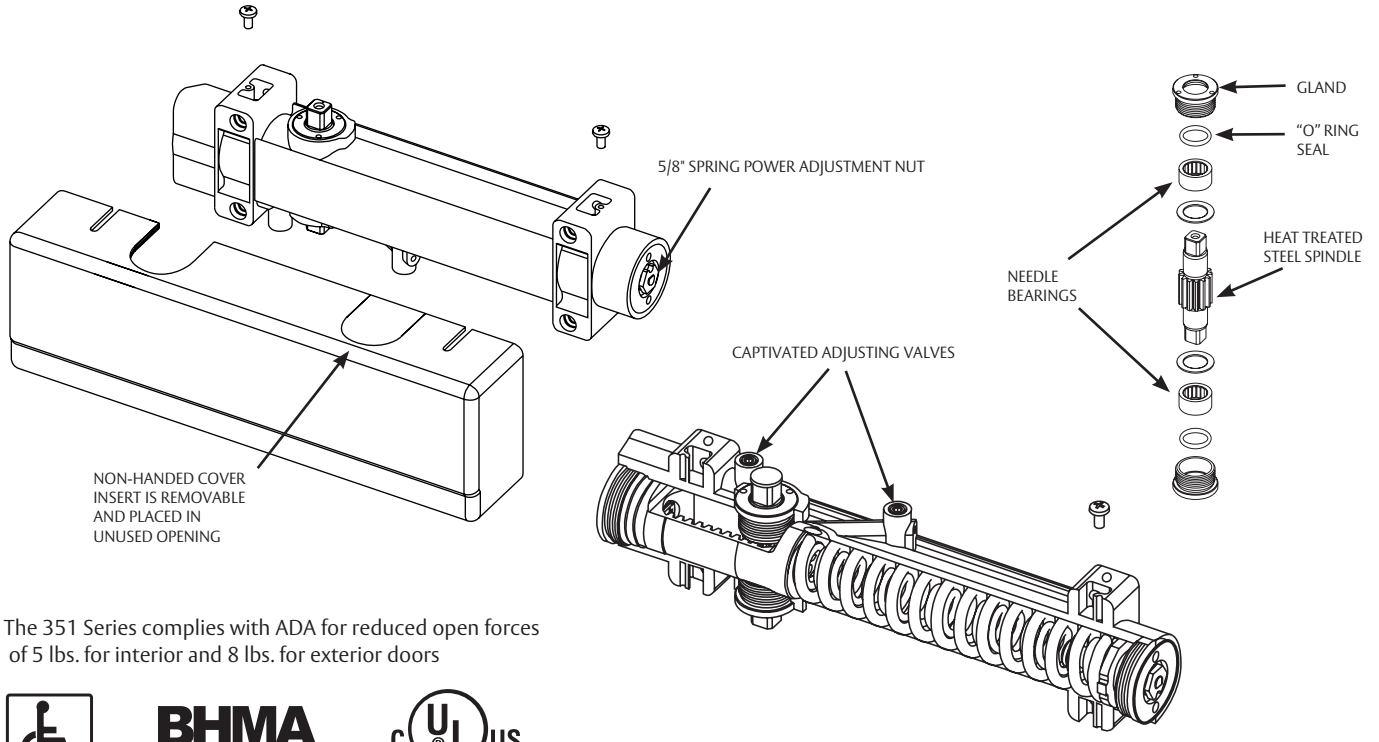

The 351 Series complies with ADA for reduced open forces of 5 lbs. for interior and 8 lbs. for exterior doors

BHMA CERTIFIED

c UL us LISTED

Features

- Certified ANSI/BHMA A156.4 Grade 1
- UL 10C listed for positive pressure fire test
- UL /cUL listed for use on fire rated doors
- 25 year limited warranty
- User friendly versatile mounting applications permit standard, top jamb, parallel and track installations
- Self sticking templates supplied for most applications
- Adjustable spring power allows 351 closers a size range of 1 through 6. They are adjusted to size 3 before leaving the factory
- One door closer body for all applications. All 351 are non-handed
- Meets ADA requirements in all applications, except Push Side Track application (except track)
- High impact non-corrosive plastic covers with two machine screws standard, metal covers and lead lined are optional
- All weather fluid allows closer to operate effectively in extreme temperatures without readjustment
- 1-1/2" diameter piston for superior door control
- Standard pressure relief valves for both opening and closing cycles protect the door & frame from damage caused by abuse

Heavy Duty Construction

- Heat treated full closed rack and pinion provide control from the full open position
- Heavy duty one piece die cast aluminum silicon alloy body with 14% silicon provides superior strength and wear resistance
- 1/2" arm engagement over a 7/16 square spindle ensures a wear-resistant tight joint

Fasteners

- Machine Screws and self tapping screws provided for closer and arm

Valves

- Brass body low sensitivity control valves offer separate regulating for door speed, latching, backcheck and optional delayed action
- All valves are controlled by an 1/8" allen wrench to discourage tampering and are captivated to prevent removing valves from the body and damaging door closer
- Adjustable backcheck (standard) protects the door and hardware from damage during the opening cycle
- Adjustable delayed action (optional) permits easy access for physically impaired individuals
- Valves are captivated to prevent accidental removal

Full Complement of Arm Types

- Interchangeable forged steel arms
- Standard and parallel arms
- Push and pull track arms (including double egress)
- Heavy duty forged steel arms are finely finished and interchangeable between SARGENT 351, 1431 and 281 Series

Standard Applications

351 Series Powerglide®

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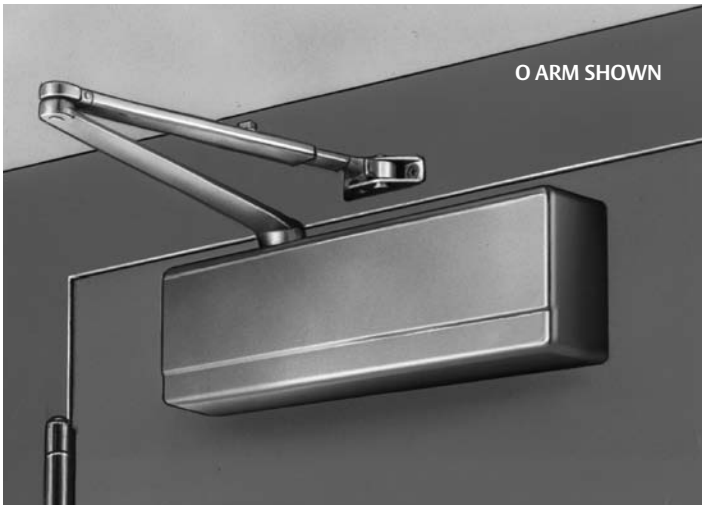
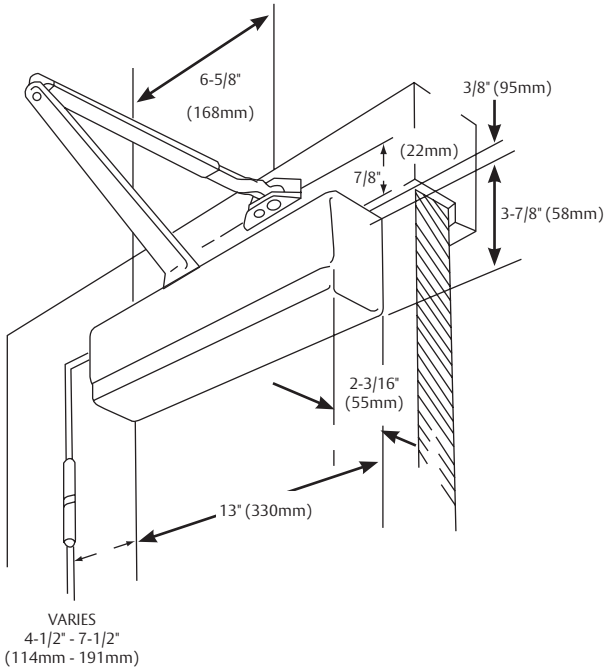


The standard application of the 351 door closer is the most common and the most desirable. The closer mounts on the hinge (pull) side of door (except when the W Corner Bracket is used). **Note:** This application is not recommended on exterior doors (the closer is not protected from weather). The cover projection normally limits the door opening to a maximum of 160°.

351-0 Standard Application



351 Standard Application for:

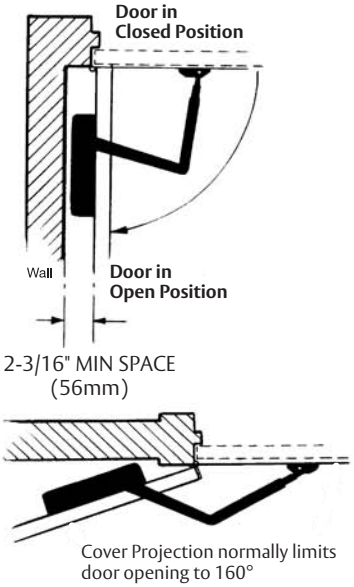
- Interior Doors Opening In or Out
- Exterior Doors Opening In
- Maximum Reveal 7/16"
- Non-hand universal body

351 Standard Application Door Opening Range

(Range based on Mounting Position)

- O- Standard Arm: 120° – 180°
- H- Hold Open Arm: 90° – 160°

Wall Clearance Requirement

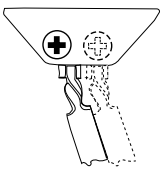


Adjustable Closing Force

- Interior doors to 5'0" wide
- Exterior doors to 4'0" wide
- Shipped factory preset for 3'0" door
- Factory pre-sized upon request

Arm Leverage Adjustment

Closers using "O" arms have the provision to increase closing power by 15% by adjusting foot pivot



Arms and Accessories for Standard Applications

351 Series Powerglide®

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O - Standard Arm

- Forged Steel Main Arm
- Non-handed
- Permits 120° door opening with standard mounting
- Permits 180° door opening with alternate mounting or corner bracket
- Can be used with the 351L retrofit plate when replacing a LCN 4040 closer

Order as 25-O x finish for arm only
Includes: 63-2607 - Main arm
63-2216 - Foot assembly
63-3684 - Screw pack

H - Hold Open Arm

- Forged Steel Main Arm
- Non-handed
- Hand is changed by inverting the foot assembly
- Friction type holder easily adjusted by a wrench
- Permits 180° door opening
- Holds open from 80° – 180°

Order as 25-H x finish for arm only
Includes: 63-2229 - Main arm
61-2303 - Foot assembly
63-3684 - Screw pack

O8 - Mortise Foot Arm

- Forged Steel Main Arm
- Non-handed
- Permits 120° door opening
- Commonly used with bull nose frames

Order as 25-O8 x finish for arm only
Includes: 63-2607 - Main arm and link assembly
63-2273 - Foot assembly
63-2391 & 63-3684 - Screw packs

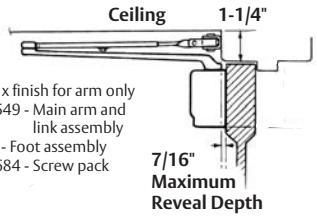
H8 - Mortise Foot Hold Open Arm

- Forged Steel Main Arm
- Handed same as door
- Friction type holder easily adjusted by a wrench
- Holds open from 80° – 180°

Order 25 R-H8 for right hand and 25 L-H8 for left hand x finish for arm only
Includes: 63-2289 - Left hand foot assembly
63-2290 - Right hand foot assembly
63-2229 - Main Arm and Link Assembly
63-2391 & 63-3684 - Screw packs

OLC - Standard Arm for Low Ceiling

- Forged Steel Main Arm
- Non-handed
- 1-1/4" between the top of door to ceiling is required for OLC Arm
- Permits 120° door opening with standard mounting



Order as 25-OLC x finish for arm only
Includes: 63-2549 - Main arm and link assembly
2216 - Foot assembly
63-3684 - Screw pack

UH Package

- Universal hold open arm package provides brackets and arms to install closer in top jamb, standard or parallel applications
- Order closer as 351-UH x finish
- 351-UH not available with (MC) metal cover or plated finishes

Screw packs
63-3684

125-PH9

UO Package

- Universal arm package provides brackets and arms to install closer in standard top jamb or parallel applications
- Order closer as 351-UO x finish
- 351-UO not available with (MC) metal cover or plated finishes

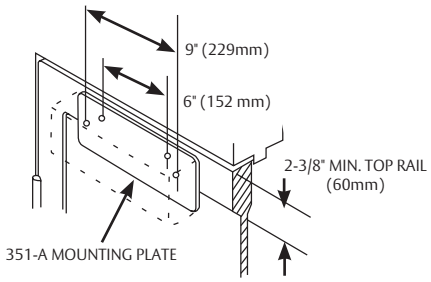
Screw packs
63-3684 &
63-2391

125-P9

351-A Mounting Plate

Allows the mounting of a 351 Closer onto a door with a minimum top rail of 2-3/8"

Order as: 351-A x finish



351- LCN Retrofit Plate

Allows an LCN 4040 closer body to be replaced with a SARGENT 351 with an O Arm without drilling new holes in door (NOTE: New holes required for arm bracket only)

Order as: 351L x finish

Top Jamb Applications

351 Series Powerglide®

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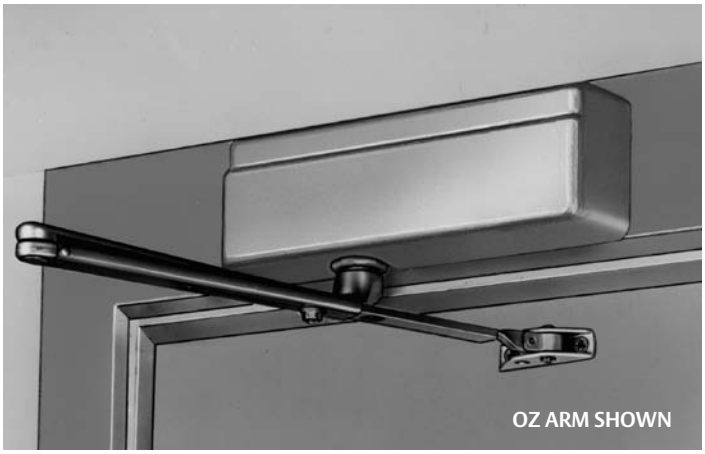
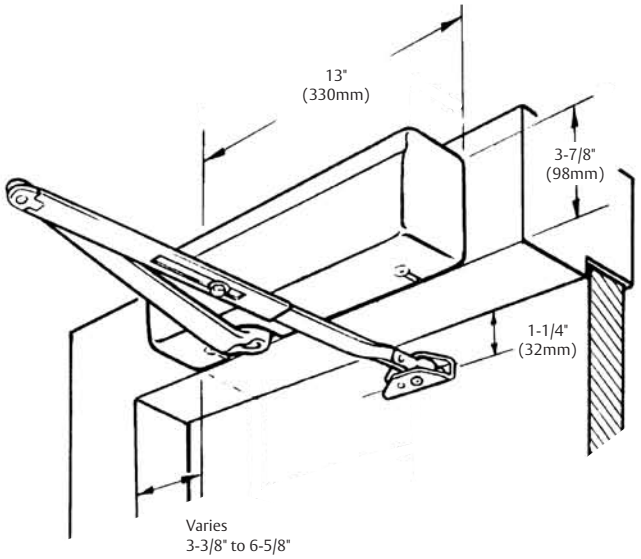


351-0 Top Jamb Mounting Position



Top Jamb applications - The 351 closer is mounted on the frame face above the door. The foot is mounted on the push side of door. This application is for use on exterior doors opening out to protect the closer from the weather.

Minimum Frame Face Required

- 3-7/8" minimum required for 351 Top Jamb applications for both single and double rabbeted frames

Minimum Door Top Rail Required to Mount Closer Foot

- 2" (51mm) minimum
- Rail height used will vary depending on type and make of auxiliary holder

Adjustable Closing Force

- Interior doors to 5'0" wide
- Exterior doors to 4'0" wide
- Shipped factory preset for 3'0" door
- Factory pre-sized upon request

351 Typical Reveal Top Jamb Applications

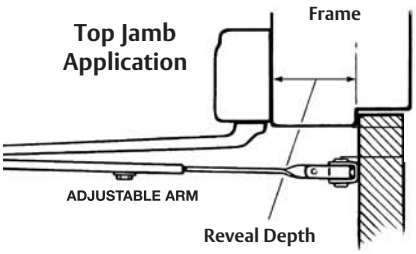
For reveals up to 2" (51mm) maximum

- O Arm - Max. Door Opening: 180°
- H Arm - Hold Open Range: 80° – 180°

351 Extra Deep Reveal Top Jamb Applications

For reveals from 5-1/8" (130mm) to 8" (230mm)

- OZA Arm - Max. Door Opening: 140°
- HZA Arm - Hold Open Range: 80° – 130°



351 Deep Reveal Top Jamb Applications

For reveals from 2-1/8" (54mm) to 5" (127mm)

- OZ Arm - Max. Door Opening: 140°
- HZ Arm - Hold Open Range: 80° – 140°

351-A & 351-B Mounting Plates

These Mounting Plates permits closers to be mounted for special applications when overhead auxiliary door holders are used or in low ceiling applications for both single and double rabbeted frames.

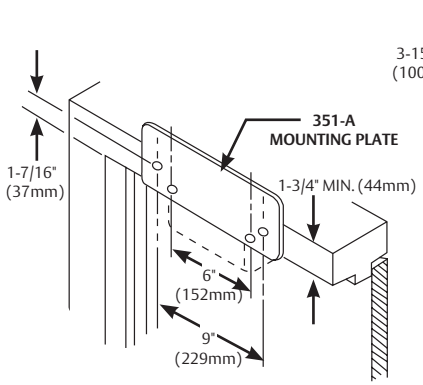
351-A Mounting Plate

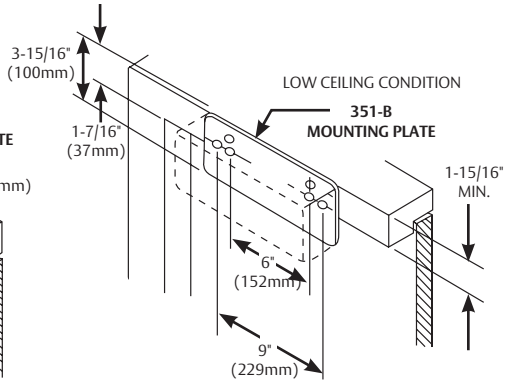
The 351-A allows top jamb mounting of a 351 with a 1-3/4" minimum frame clearance.

351-B Mounting Plate

The 351-B for low ceiling applications allows top jamb mounting of a 351 with a minimum 1-15/16" frame.

- Plates are painted or plated steel to match closer
- Plates are non-handed
- Order as 351-A x finish or 351-B x finish





Arms for Top Jamb Applications

351 Series Powerglide®

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Narrow Reveal

O - Standard Arm

- Forged Steel Main Arm
- For reveals up to 2" (51mm)
- Non-handed
- Permits 180° door opening

Order as 25-O x finish for arm only
Includes: 63-2607 - Main arm assembly
63-2216 - Foot assembly
63-3684 - Screw pack

H - Hold Open Arm

- Forged Steel Main Arm
- For reveals up to 2" (51mm)
- Adjustable friction holder
- Non-handed
- Permits 180° door opening

Order as 25-H x finish for arm only
Includes: 63-2229 - Main arm assembly
61-2303 - Foot assembly
63-3684 - Screw pack

Deep Reveal Arms

OZ - Standard Arm for Deep Reveals

- Forged Steel Main Arm
- For reveals from 2-1/8" (54mm) to 5" (127mm)
- Non-handed
- Permits 140° door opening

Order as 25-OZ x finish for arm only
Includes: 63-2607 - Main arm assembly
63-2217 - Foot assembly
63-3684 - Screw pack

HZ - Hold Open Arm for Deep Reveals

- Forged Steel Main Arm
- For reveals from 2-1/8" (54mm) to 5" (127mm)
- Adjustable friction holder
- Non-handed
- Permits 140° door opening

Order as 25-HZ x finish for arm only
Includes: 63-2230 - Main arm assembly
61-2303 - Foot assembly
63-3684 - Screw pack

Extra Deep Reveal Arms

OZA - Standard Arm for Extra Deep Reveal

- Forged Steel Main Arm
- For reveals 5-1/8" (130mm) to 8" (203mm)
- Non-handed
- Permits 140° door opening

Order as 25-OZA x finish for arm only
Includes: 63-2607 - Main arm assembly
63-2218 - Foot assembly
63-3684 - Screw pack

HZA - Hold Open Arm for Extra Deep Reveal

- Forged Steel Main Arm
- For reveals 5-1/8" (130mm) to 8" (203mm)
- Adjustable friction holder
- Non-handed
- Permits 140° door opening

Order as 25-HZA x finish for arm only
Includes: 63-2231 - Main arm assembly
61-2303 - Foot assembly
63-3684 - Screw pack

Parallel Arm Applications

351 Series Powerglide®

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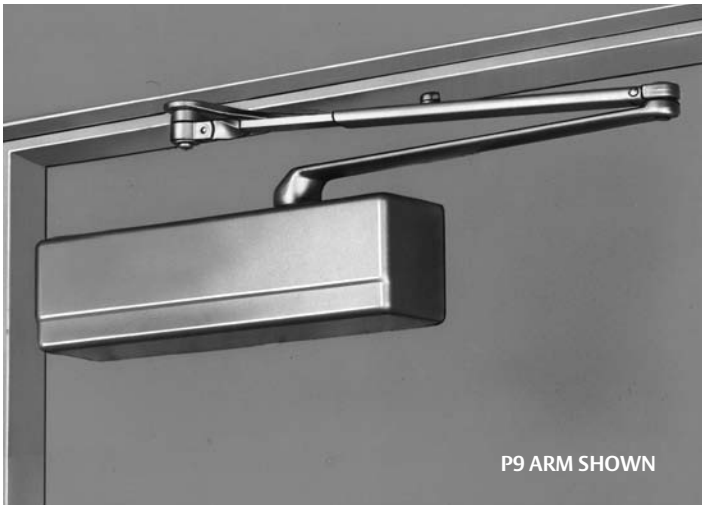
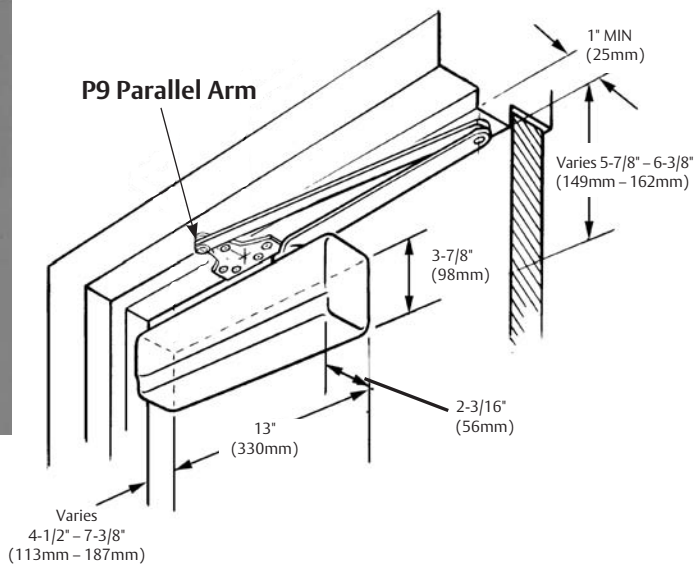


Parallel Arm Applications - The 351 closer is mounted on the push side of the door. As the door opens, the closer swings with the door and gives full headroom in the door opening. Other advantages: the closer arm does not project into the room; the frame can be quite narrow and the door can be swung open much farther than in Top Jamb Applications.

351-P9 Regular Duty Parallel Arm



Heavy Duty Parallel Arms

For use in high traffic and abusive environments

- Forged steel arm and cast iron foot bracket for strength and durability
- Oiled bronze bearings for superior wear resistance
- 2 piece rigid arms for ease of installation
- Friction and positive hold open arms available
- Use friction hold open arms for doors subject to moderate hold open use
- Dead stop and compression stop arms available
- Security non-hold open arms available

Non hold-open arms

- Two mounting positions for 120° and 180° maximum door openings

Stop arms

- 6 mounting positions with PS or CPS arms to allow stop from 85°–110°

Regular Duty Parallel Arms

Available Arms for institutional installations:

- Regular duty parallel arms
- Offset bracket arms for use with Auxiliary Holders & Stops
- Parallel flush frame arms
- Flush frame arms for use with Auxiliary Holders & Stops
- Flush frame, friction Hold Open Arms

NON HOLD OPEN ARMS

- Two mounting positions for 120° and 180° maximum door opening

HOLD OPEN ARMS

- Friction hold open arms available for doors subject to moderate hold open use
- 6 mounting positions to hold open from 85° – 110° with PSH or CPSH arms

Heavy Duty Parallel Arms

351 Series Powerglide®

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P10 - Heavy Duty Parallel Arm

- Forged Steel Constructions
- Non-Handed
- Easily installed
- Permits 120° opening at standard mounting
- Permits 180° opening at alternate mounting
- Can be used with the 351L retrofit plate when replacing a LCN 4040 closer

Order as 25-P10 x finish for arm only
25-P10 Includes: 63-0641 - Main arm
63-3727 - P10 foot assembly
63-3684 & 63-2392 - Screw packs

PS - Heavy Duty Parallel Arm with Positive Stop

- Forged Steel Constructions
- Handed arm is field-reversible
- Provides built in stop from 85° – 110°
- Permits 110° opening maximum
- Easily installed
- Permits 85° – 110° door opening

Order as 25-PS x finish for arm only
Includes: 63-0641 - Main arm
63-3837 - PS foot assembly
63-3684 & 63-2398 - Screw packs

CPS - Heavy Duty Parallel Arm with Compression Stop

- Forged Steel Constructions
- Provides built in compression stop from 85° – 105°
- Permits 105° opening maximum
- Easily installed
- Handed arm is field-reversible
- Dead stop within 3°

Order as 25-CPS x finish for arm only
Includes: 63-0641 - Main arm
63-3830 - CPS foot assembly
63-0516 - Bumper holder
63-3493 - Bumper
63-3684 & 63-2398 - Screw packs

SP10 Heavy Duty Security Arm

- Same as P10, except factory assembled at arm joint (elbow) to prevent disassembly in SSP package along with metal cover

PH10 - Heavy Duty Friction Hold Open Parallel Arm

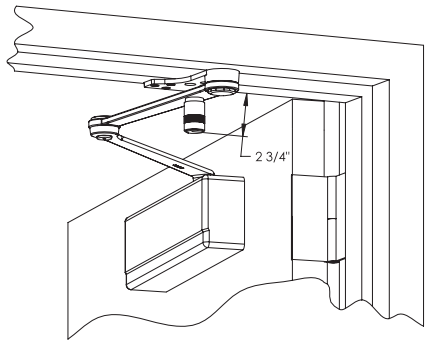
- Forged Steel Constructions
- Adjustable hold open from 75° – 180°
- Forged steel arm 11-1/4" (286mm) long
- Handed same as door
- Use friction hold open arms for doors subject to moderate hold open use

Order as 25-PH10 x finish for arm only
25-PH10 Includes: 63-0641 - Main arm
63-3839 - Left hand PH10 foot assembly
63-3840 - Right hand PH10 foot assembly
63-3684 & 63-2392 - Screw packs

PSH - Heavy Duty Parallel Hold Open Arm with Positive Stop

- Forged Steel Constructions
- Provides holder and stop features
- Handed arm is field-reversible
- Easily installed/adjusted
- Permits 85° – 110° door opening

Order as 25-PSH x finish for arm only
Includes: 63-0641 - Main arm
63-3833 - PSH foot assembly
63-3684, 63-2392 & 63-2398 - Screw packs



The PSH and CPSH arms project 2-3/4" below the head stop

CPSH - Heavy Duty Hold Open Parallel Arm with Compression Stop

- Forged Steel Constructions
- Handed arm is field-reversible
- Provides built in compression stop and holder mechanism from 85° – 105°
- Easily installed/adjusted
- Permits 105° opening maximum
- Dead stop within 3°

Order as 25-CPSH x finish for arm only
Includes: 63-0641 - Main arm
63-3836 - CPSH foot assembly
63-0516 - Bumper holder
63-3493 - Bumper
63-3684, 63-2392 & 63-3487 - Screw packs

Positive Stop Hold Open Arms (PSH & CPSH ARMS)

- Use on doors subject to repetitive hold open use
- 6 hold open positions from 85° – 110° determined by mounting position
- Hold open function may be disengaged
- Hold open tension is easily adjustable

Regular Duty Parallel Arms

351 Series Powerglide®

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Standard Arms

P9 - Standard Parallel Arm

- Forged Steel Main Arm
- Non-handed
- Can be used with the 351L retrofit plate when replacing a LCN 4040 closer

Order as 25-P9 x finish for arm only
Includes: 63-2607 - Main arm
63-3405 -Foot assembly
63-3684 & 63-2391 - Screw packs

Regular Duty Hold Open Arms

PH9 - Friction Hold Open Arm

- Forged Steel Main Arm
- Holds open from 75° – 180°
- Easily adjusted by wrench
- Non-handed

Order as 25-PH9 x finish for arm only
Includes: 63-2229 - Main arm
61-2303 - Foot assembly
64-0039 - Foot bracket (125 PH9)
63-3684 & 63-2391 - Screw packs

PH4 - Flush Frame, Friction Hold Open Arm

- Forged Steel Main Arm
- Holds open from 75° – 180°
- Easily adjusted by wrench
- Non-handed
- Use on frames where stop or soffit is too narrow to mount the standard hold open foot bracket

Order as 25-PH4 x finish for arm only
Includes: 63-2229 - Main arm
61-2303 - Foot assembly
64-0050 - Foot bracket
63-3684 & 63-2391 - Screw packs

Offset Brackets for use with overhead stops, holders and door coordinators

P3 - 1" Offset Bracket for use with Auxiliary Holder/Stop

- Forged Steel Main Arm
- For use with auxiliary surface overhead stops and holders
- Foot bracket is offset 1" more than P-9, allowing door closer to be lowered on door face
- Non-handed

Order as 25-P3 x finish for arm only
Includes: 63-2607 - Main arm
63-2270 - Foot assembly
63-3684 & 63-2391 - Screw packs

P3A - 1-3/4" Offset Bracket for use with Auxiliary Holder/Stop

- Forged Steel Main Arm
- For use with auxiliary surface overhead stops and holders and door coordinators
- Foot bracket lowers door closer an additional 3/4" below P3 bracket
- Non-handed

Order as 25-P3A x finish for arm only
Includes: 63-2607 -Main arm
63-2274 - Foot assembly
63-3684 & 63-2391 - Screw packs

P4 - Parallel Flush Frame Arm

- Forged Steel Main Arm
- Foot bracket is attached to frame or transom face
- For use where stop or soffit is too narrow for the standard P9
- Permits 120° opening with standard mounting
- Permits 180° opening with alternate mounting
- Non-handed

Order as 25-P4 x finish for arm only
Includes: 63-2607 - Main arm
63-2295 - Foot assembly
63-3684 & 63-2391 - Screw pack

P4A - Flush Frame Arm for use with Auxiliary Holder/Stop

- Forged Steel Main Arm
- For use with auxiliary surface overhead stops and holders
- Foot bracket is attached to frame or transom face
- Foot bracket lowers door closer an additional 3/4" below P4 bracket
- Non-handed

Order as 25-P4A x finish for arm only
Includes: 63-2607 - Main arm
63-2272 - Foot assembly
63-3684 & 63-2391 - Screw packs

Tri-Packs

UO Package

- Universal arm package provides arms and brackets to install closer in standard top jamb or parallel application

351-UO not available with (MC) metal cover or plated finishes

Screw pack 63-3684

125-P9

UH Package

- Universal hold open arm package provides brackets and arms to install closer in top jamb, standard or parallel applications

351-UH not available with (MC) metal cover or plated finishes

Screw pack 63-3684

125-PH9

Accessories for Parallel Applications

351 Series Powerglide®

SARGENT
ASSA ABLOY

Heavy Duty Parallel Arm Accessories

581-2 Blade Stop Spacer Kit

- For frames with 1/2" blade stops
- For use with P10, PH10, PS, PSH, CPS and CPSH arms
- 125-V bracket included
- Packed with 1-1/4" long screws

Use P/N 63-0756 to order blade stop only

125-V/125-VF Brackets

125-V

125-VF

- For use with all heavy duty parallel arms
- Use 125-V for narrow stop and frame conditions
- Use 125-VF for flush door and frame conditions

Spacer 63-0191

- 1/2" x 5/8"
- Included standard with PS, PSH, PH10, P-10 CPS and CPSH arm for use with rabbited frames

Regular Duty Parallel Arm Accessories

125-P3 Arm Conversion Unit

- Converts O or P9 arm to P3 Parallel Arm

125-P3A Arm Conversion Unit

- Converts O or P9 Arm to P3A Parallel Arm

125-PH9 Parallel Arm Foot

- Converts standard hold open (H) arm to PH9 Parallel Hold Open Arm

125-P4 Conversion Unit

- Converts O or P9 Arm to P4A Arm

125-P4A Arm Conversion Unit

- Converts O or P9 arm to P4A Arm

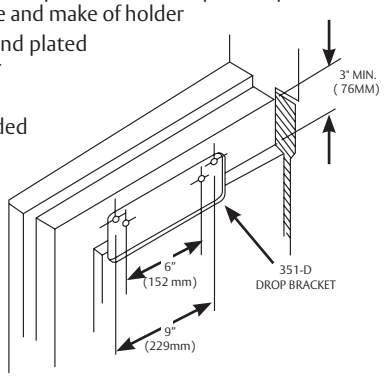
581-1 Blade Stop Spacer Kit

- For frames with 1/2" blade stops
- For use with P9, PH9 and PF9 arms only
- Packed with 1-1/4" long screws

Regular Duty Parallel Arm Accessories

351-D Drop Plate

- Permits mounting parallel arm 351 Series Closer applications on doors with narrow top rails
- Requires 3" (76mm) minimum top rail
- For closers used with overhead stops and holders, top rail requirements will vary depending upon type and make of holder
- Available with powder coat and plated finishes to match door closer
- Plates are not handed
- Plate mounting screws included
- Order as 351-D x finish



351L - LCN RETROFIT Plate

The 351L allows replacement of LCN 4040 closer body with a SARGENT 351 without drilling new holes in door (**Note:** New mounting holes required for arm bracket only)

- 351L Retrofit Plate:
  Can be used with these parallel arms
  - P9 – Regular Duty Parallel Arm
  - P10 – Heavy Duty Parallel Arm
- Plates are non-handed
- Available in powder coat and plated finishes
- Order as: 351L x finish

Track Type Applications

351 Series Powerglide®

SARGENT
ASSA ABLOY

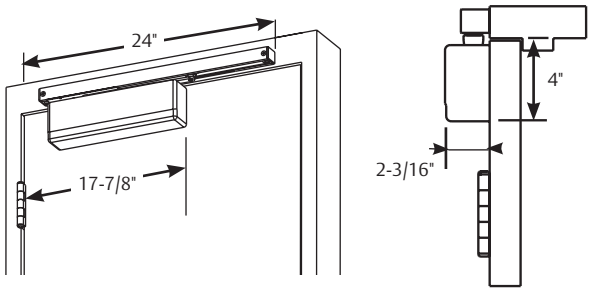
Pull Side Mounting (Hinge Side)

The closer is for use on interior doors opening in or out. As the door opens, the closer swings with the door. This affords a variable hold-open feature option.

Pull Side Track Application

Arm & Track	Description
OT	Pull Standard pull side
OTB	Pull Track with bumper
HT	Pull Holder
HTB	Pull Holder with bumper

Track Arm Applications



Pull Hinge Side Mounting (Track mounts on frame face)

- Minimum top rail required with a 351-A plate = 2-1/4" (57mm)
- Minimum top rail required without mounting plate = 4" (102mm)

Maximum Door Opening

- 160° with standard track
- 120° with optional bumper track
- 180° with standard track if frame conditions permit

Hold Open Range

- 85° – 120°

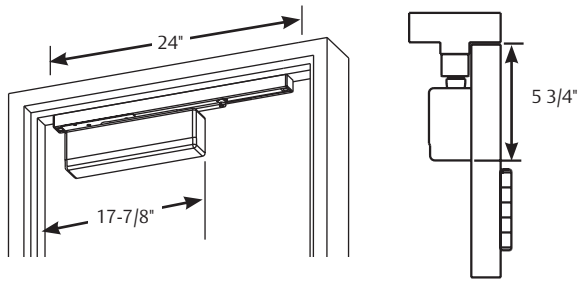
Push Side Mounting (Stop Side)

The closer is for use on interior doors opening in or out. As the door opens, the closer swings with the door. This affords a variable hold-open feature option.

Push Side Track Application

Arm & Track	Description
POT	Push Standard
POTB	Push Bumper
PHT	Push Holder
PHTB	Push Holder and bumper

Track Arm Applications



Push Stop Side Mounting (Track mounts on frame stop)

- Minimum top rail required without drop plate = 5-3/4" (146mm)
- 3" (76mm) minimum top rail required with 351-D Drop Plate

Minimum Stop Required

- 1-9/16" (40mm) wide

Maximum Door Opening

- 100° with standard track
- 95° with optional bumper track

Hold Open Range

- 85° – 95°

Common Features

Standard Finishes

- EAB, EB, ED, EN, EP, powder coated on all exposed surfaces
- Architectural plated arms and covers optional

Track

- Extruded aluminum track

Arm

- Forged steel

Bumper (optional)

- Mounts in track to assist backcheck
- Not designed to be used as a stop
- Auxiliary stop is required
- Available for both regular or hold open tracks

Holder (optional)

- Mounts within the track (adjustable)

Non Sized-Adjustable

- Interior doors to 5'0" wide
- Shipped factory preset for 3'0" door
- Factory pre-sized upon request

Double Egress Applications

351 Series Powerglide®

SARGENT
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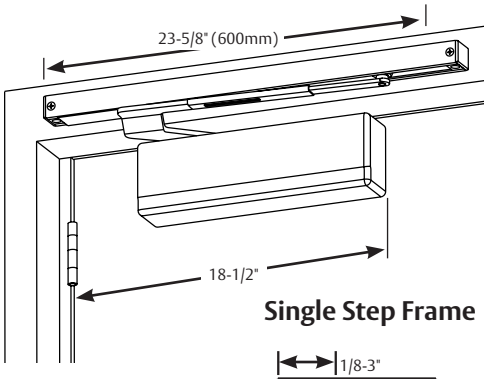
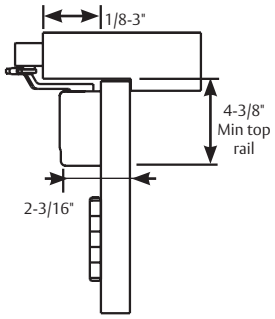
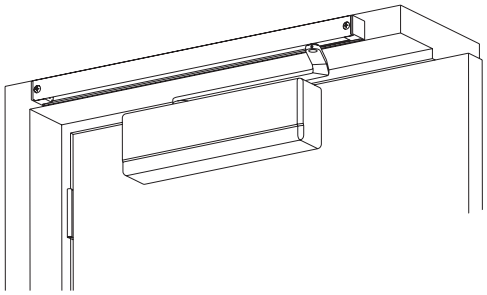
ODS - Single Step Double Egress Arm



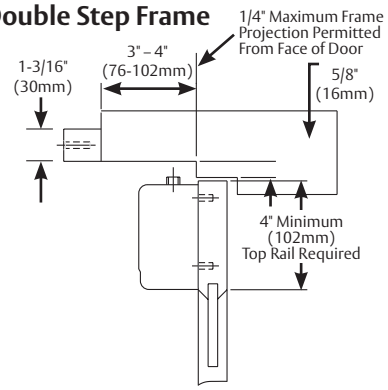
Single Step Frame



OD - Double Step Double Egress Arm



Double Step Frame



ODS Applications

- 160° maximum door opening
- 120° opening with bumper option
- Range of hold open 85°–120°
- Used with reveals 1/8" – 3" (3mm-76mm)

Track

- Extruded aluminum track
- End caps finished to match track

Arm

- Forged steel
- Bearing roller
- Arm handed same as door

Non Handed

- Universal body

Finishes (Powder Coat)

- EAB, EB, ED, EN, EP (standard for all exposed surfaces)

Bumper (optional)

- Mounts in track to assist backcheck
- Not designed to be used as a stop
- Auxiliary stop is required
- Available for both regular or hold open tracks

Holder (optional)

- Mounts within the track (adjustable)

Non Sized-Adjustable

- Interior doors to 5'0" wide
- Shipped factory preset for 3'0" door
- Factory pre-sized upon request

Double egress track arms are used when the aesthetics of a track application is required on the pull side of a deep reveal frame.

This application is commonly used on cross corridor openings.

Double Egress Track Applications

OD	Double step double egress
ODB	Double step double egress with bumper
HD	Double step double egress with holder
HDB	Double step double egress with bumper and holder
ODS	Single step double egress
ODSB	Single step double egress with bumper
HDS	Single step double egress with holder
HDSB	Single step double egress with bumper and holder

OD Applications

- 160° maximum door opening
- 120° opening with bumper option
- Range of hold open: 85° – 120°
- Used with reveals 3" – 4" (76mm-101mm)

Track

- Extruded aluminum track
- End caps finished to match track

Arm

- Forged steel
- Bearing roller
- Arm is handed same as door

Non Handed

- Universal Body

Finishes (Powder Coat)

- EAB, EB, ED, EN, EP (standard for all exposed surfaces)

Bumper (optional)

- Mounts in track to assist backcheck
- Not designed to be used as a stop
- Auxiliary stop is required
- Available for both regular or hold open tracks

Holder (optional)

- Mounts within the track (adjustable)

Non Sized-Adjustable

- Interior doors to 5'0" wide
- Shipped factory preset for 3'0" door
- Factory pre-sized upon request

Pocket Door Applications

351 Series Powerglide®

SARGENT
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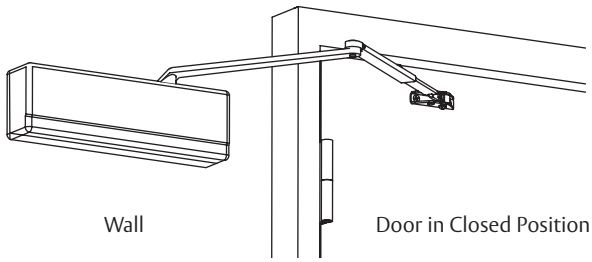
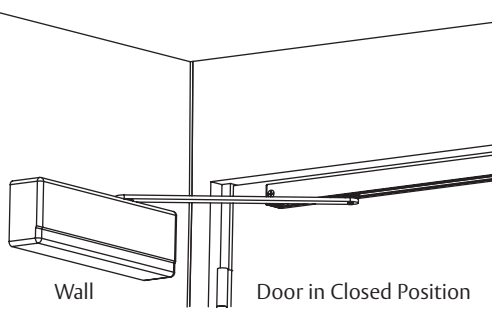
OP - Double Lever Arm Application



OTP - Track Type Application



Pocket Door Applications

The 351 Series Powerglide Door Closer body is mounted on the wall and installed so that it pushes the door closed. This application is typically used with fire doors that are held open. In this application when the door is open, the closer and arms are completely hidden from view.

OP - Pocket Arm Application

- 180° Maximum Opening
- Non handed

Note: 90° Maximum Opening, use OTP Track Type

Arm

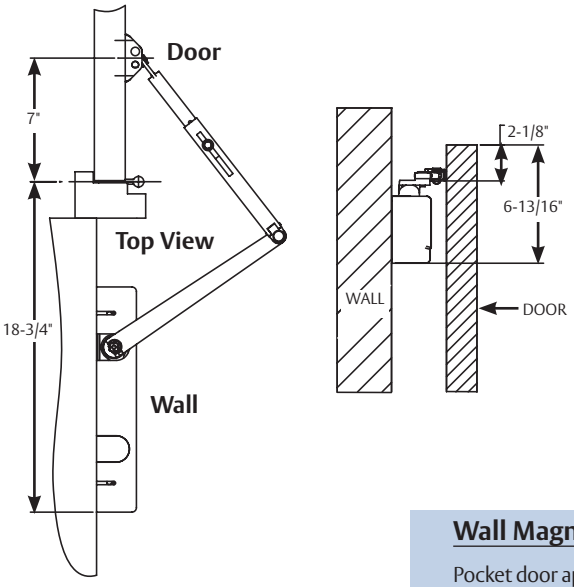
- Forged steel

Non Handed

- Universal Body

Finishes (Powder Coat)

- EAB, EB, ED, EN, EP (standard for all exposed surfaces)
- Plated Covers and arms available



OTP - Track Type Application

- 90° Maximum Opening
- Extruded Aluminum Track
- Non handed

Arm

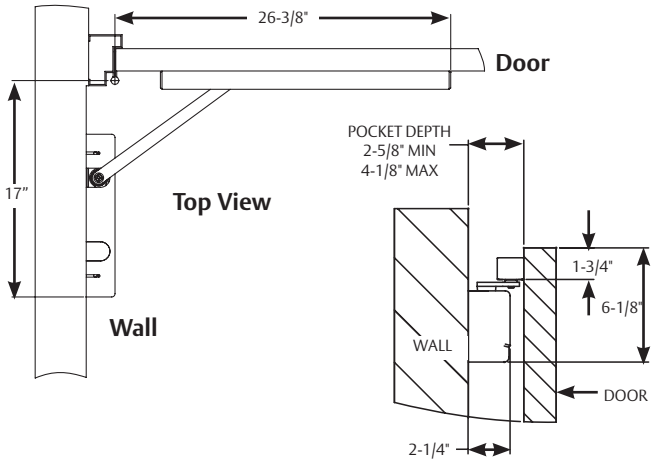
- Forged steel
- Bearing roller

Non Handed

- Universal Body

Finishes (Powder Coat)

- EAB, EB, ED, EN, EP (standard for all exposed surfaces)
- Plated Covers and arms available



Wall Magnets - see SARGENT holders and stops catalog

Pocket door applications commonly use wall mounts (wall magnets).

1560 Surface Mount

1561 Flush Mount

How to Order, Options and Finishes

351 Series Powerglide®

SARGENT
ASSA ABLOY

Packing

All closer assemblies are packaged 4 per carton. On request, door closers will be packed 2 per carton.

Series	Number per Carton	Approx. wt per Carton
351	4-Standard (2 upon request)	19 lbs. per 4

How To Order

CPC-DA	351	P4H	26	LH
Options	**Series**	**Closer Arm**	**Finish**	**Hand**
31- 36- 74- CPC- DA- MC- SG- SRI- TB-	351	Standard Page 7 Top Jamb Page 9 Parallel Pages 11 & 12 Track Type Page 14 & 15	EB ED EN EP EAB 03* 04* 09* 10* 10B* 10BE 10BL* 14* 15* 20D* 26* 26D* BSP	LH RH

* These finishes are automatically provided with a metal cover

Options Available

Specify	Detailed Description
31-	For doors 1-7/8" – 2-1/4" thick, specify door thickness, doors over 2-1/4" thick contact factory
36-	Security Torx Screws
74-	Lead lined cover
CPC-	Clear Powder Coat (available on 26 & 26D)
DA-	Delayed Action
MC-	Handed Metal Cover
SRI-	Special Rust Inhibitor finish for powder coated finishes only (arm)
TB-	Through Bolt (1-3/4" Std) For others, specify 31-TB- & door thickness

Note:

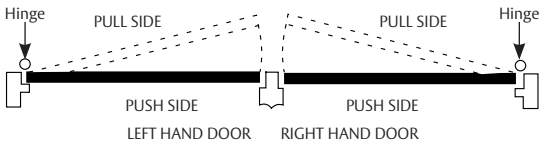
- The MC- option is used when a metal cover is desired on a powder coated finish
- When MC- is added to a plated finish, the MC- option indicates that only the cover is to be plated, the arms will be powder coated to match
- Do not specify the MC suffix if both the cover and arms are to be plated

How To Order Accessories

Accessories	Example	
Arm Only	Specify arm required and finish	25-PSH EN
Closer Body Only	Specify: CB-351*	CB-351
Arm conversion Units	Specify unit and finish	125-P4 EB
Cover Only (Standard)	351-C x finish	351-C EN
Cover Only (Metal)	351-CMC x finish and hand & arm type	351-CMC + 26D + LH + P10

Note: When complete closer assembly is ordered with an accessory, order accessory as a separate item

*DA (Delay Action) option is available with closer body

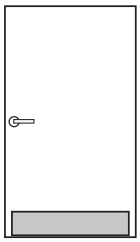


Finishes

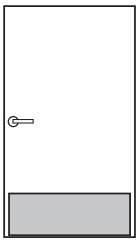
Finishes	ANSI/BHMA	Description
EB	695	Bronze powder coated to match finish 10B
EN	689	Aluminum powder coated
ED	693	Black powder coated to match finish 20D
EAB	696	Brass powder coated
EP	691	Bronze powder coated to match finish 10
03	605	Bright brass, clear coated
04	606	Satin brass, clear coated
09	611	Bright bronze, clear coated
10	612	Satin bronze, clear coated
10B	613	Dark oxidized satin bronze, oil rubbed
10BE	613E	Dark oxidized satin bronze - equivalent
10BL	614	Oxidized satin, bronze, clear coated
14	618	Bright nickel plated, clear coated
15	619	Satin nickel, clear coated
20D	624	Statuary dark bronze, clear coated
26	625	Bright chromium plated
26D	626	Satin chromium plated
BSP	—	Black Suede Powder Coat

Special Rust Inhibitor Process (SRI)

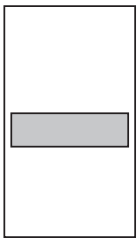
Additional process available for bracket and arms provides an extra layer of protection for extreme corrosive environments. Available with powder coated finishes only, specify SRI- as an option when ordering.



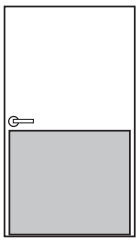
Mop Plate
Up to 6" h x 48" w



Kick Plate
6" to 12" h x 48" w



Stretcher Plate
6" to 12" h and up to 48" w



Armor Plate
Up to 48" h x 48" w and available in most finishes

OPTIONAL Self-Drilling TEK Screws: Cuts door plate installation time in half.

Width of Plates:
Push Side: 2" less than door width.
Pull Side: 1 1/2" less than door width.

NFPA 80 STANDARDS — 2-4.5 Protection Plates: Factory-installed protection plates shall be installed in accordance with the listing of the door. Field-installed protection plates shall be labeled and installed in accordance with their listing.

Exception: Labeling is not required where the top of the protection plate is not more than 16" (406 mm) above the bottom of the door.

Metal Door Plate – Economy Duty No. K1038

Material: .038" aluminum, stainless steel
Finishes: US32D
Fastener: #6 x 5/8" OH SMS
Ordering: Specify height x width x finish code. Add any options
Weight: 8" x 34" = 3.2 lbs
Options:
- SA – self-adhesive mounting
- TORX – security Torx screws
- TEK – self-drilling screws
- Cutouts for locks, louvers, or windows (see worksheets on pages C14-C15 for details on how to order)

Metal Door Plate - Standard Duty No. K1050

Material: .050" Stainless Steel
Finishes: US32D
Fastener: #6 x 5/8" OH SMS
Ordering:

Size	High	Width
8x34BEV.32D	8"	34"
10x34BEV.32D	10"	34"
34x34BEV.32D	34"	34"

Options:
- Beveled Edge and Counter Sink included
- One day shipping available
- Door markings are not available on quick ship

Metal Door Plate – Standard Duty No. K1050, K1050F

Material: .050" aluminum, brass, bronze, stainless steel
Finishes: US10BE, US32D, US32DMS
Fastener: #6 x 5/8" OH SMS
Ordering: Specify height x width x finish code. Add any options
Weight: 8" x 34" = 4.0 lbs
ANSI: J101 - metal armor plate, J102 - metal kick plate, J103 - metal stretcher & mop plate

Options:
- SA – self-adhesive mounting
- TEK – self-drilling screws
- Beveled 3 or 4 edges, specify B3E or B4E
- Cutouts for locks, louvers, or windows (see worksheets on pages C14-C15 for details on how to order)
- Heavy bevel available, specify HVBEV
- Screw mounting (K1050F) and UL listed for use on 90-minute label wood doors and 3-hour label metal doors
- CSK – countersunk holes
- TORX – security Torx screws

Windstorm Plate – K1050WS

Material: 050" Aluminium, Brass, Bronze, Stainless Steel
Finishes: Standard Architectural Finishes
Fastener: #10x5/8" Pan Head Tek Screws
Ordering: Part # when ordering is K1050WS
All plates are UL and Windstorm rated
Options:
- Cutouts for locks, louvers or windows
- Rounded Corners
- Heavy Bevel
- Screw Mount only

Certified to the below standards:
- ICC-500 (2014)
- FEMA Guideline 320 (2014)
- FEMA Guideline 361 (2015)

Part of windstorm assembly cards: ZHLA.45, ZHLA.46, ZHLA.47, ZHLA.51, ZHLA.53, ZHLA.54

Heavy Duty Door Stop No. 466

Material: Flame resistant molded rubber bumper

Finishes: Black

Mounting: Drill 1" dia. x 2 1/2" deep hole, fill with anchoring grout

Features:
- Ideal for use in high vandalism or security areas
- No exposed fasteners

No.	Diameter	Height	Mounting Bolt	Weight
466	2" dia.	x 1 1/2" h	5/8" x 2 1/2"	0.6 lbs.

Heavy Duty Door Stop No. 467

Material: Flame resistant molded rubber bumper

Finishes: Black

Mounting: Drill 1" dia. x 2 1/2" deep hole, fill with anchoring grout

Features:
- Suitable for concrete floor or wall mounting
- Ideal for use in high vandalism or security areas
- No exposed fasteners
- Accepted by the New York State Office of Mental Health (OMH) for use in high risk areas

No.	Diameter	Height	Mounting Bolt	Weight
467	2" dia.	x 3 1/2" h	5/8" x 2 1/2"	0.9 lbs.

Heavy Duty Door Stop No. 468

Material: Wrought stainless steel and black rubber bumper

Finishes: US32D

Mounting: Drill 1 1/2" dia. x 7" deep hole, fill with anchoring grout

Features:
- Ideal for use in high vandalism or security area
- No exposed fasteners
- Accepted by the New York State Office of Mental Health (OMH) for use in high risk areas

No.	Diameter	Height	Mounting Bolt	Weight
468	2" dia.	x 3" h	1" x 7"	2.6 lbs.

Cast Universal Dome Stop No. 441H

Material: Solid cast brass with DuraFlex bumper

Finishes: Available in standard architectural finishes (see page 9)

Features: Low lip dome stop with height of high dome stop, eliminates the need to determine requirement for traditional low or high dome stop — one stop for all applications. Integral cast pin for added strength. Universal screw pack included for all floor conditions

Options: Exterior pack screw packs, stainless steel plated to match — use EXP suffix (441H x EXP) when ordering.

No.	Fastener	Base	Height	Weight	ANSI A156.16
441H	#12 x 1 1/4" FH WS, plastic anchor	7/32" h x 1 7/8" dia.	1 11/16"	3.2 lbs./10	L02141
	#12 - 24 x 1" FH MS, lead anchor				L02161

High Dome Stops No. 442, 443

Material: Solid cast brass with DuraFlex bumper

Finishes: Available in standard architectural finishes (see page 9)

Other: No. 443 is packed with both WS and MS fasteners

Features: For doors with thresholds or undercut doors

Options: Exterior pack screw packs, stainless steel plated to match — use EXP suffix (442 x EXP) when ordering.

No.	Fastener	Base	Height	Weight	ANSI A156.16
442	#12 x 1 1/2" FH WS, plastic anchor	1/2" h x 1 7/8" dia.	1 1/2"	2.8 lbs./10	L02161
443	#12 x 1 1/2" FH WS, plastic anchor; #12 - 24 x 1" FH MS, lead anchor	1/2" h x 1 7/8" dia.	1 1/2"	3.2 lbs./10	L02161

No. 445

No. 445H

Heavy Duty Door Stop No. 445, 445H

Material: Solid cast brass with DuraFlex bumper

Finishes: Available in standard architectural finishes (see page 9)

Features: Extra heavy duty dome type stop for heavy and high frequency doors

Options: Exterior pack screw packs, stainless steel plated to match — use EXP suffix (445 x EXP) when ordering.

No.	Fastener	Base	Height	Weight
445	2 ea. #12 x 1 1/2" FH SMS, plastic anchor; #12 - 24 x 1" FH MS, lead anchor	2" x 4"	1 1/8"	5.5 lbs./10
445H	2 ea. #12 x 1 1/2" FH SMS, plastic anchor; #12 - 24 x 1" FH MS, lead anchor	2" x 4"	1 11/16"	5.5 lbs./10

ASSA ABLOY

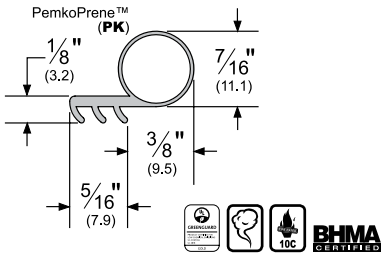
The global leader in door opening solutions

Kerf-In Weatherstrip (Cont.)

PK52_

AVAILABLE FINISHES: **BL, W**
ANSI: **R0G154**
AVAILABLE LENGTHS: **18', 20', 300'**

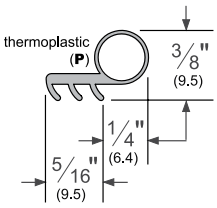
- Minimum space between the door face and the stop is 1/16"; maximum space is 3/8"



P50_

AVAILABLE FINISHES: **BL, W**
AVAILABLE LENGTHS: **17', 25', 250'**

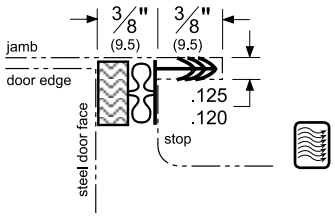
- Minimum space between the door face and the stop is 1/16"; maximum space is 5/16".
- Thermoplastic elastomer formulation will not transmigrate; remains flexible to -60° F



MAG349_

AVAILABLE FINISHES: **D, W**
AVAILABLE LENGTHS: **37", 85", 96", 121"**

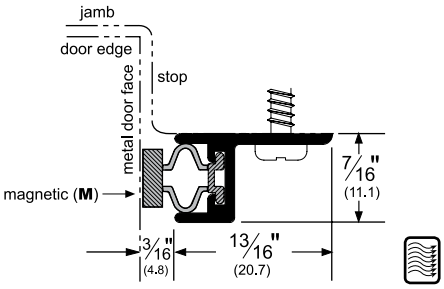
- Minimum space between the door face and the stop is 3/8"; maximum space is 7/16"
- Magnetic kerf-in weatherstrip features a magnetic strip encased by a UV-stable TPE cover
- Use for steel-faced door and wood frame applications
- Can be trimmed in the field and corner-mitered



Magnetic Kerf-In Weatherstrip

2815_M

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **2815MAG**



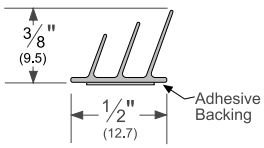
Adhesive Perimeter Gasketing

For more information on these perimeter gasketing products, please see the Adhesive Gasketing section.

S773_

AVAILABLE FINISHES: **BL, D, GR, W**
AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 250', 500'**
ANSI: **R0E154, R0E155**

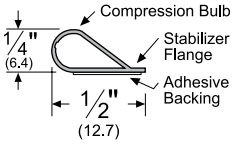
- Triple-fin design blocks light and sound from infiltrating a room
- Product designed as hospitality gasketing (see more hospitality products in the Hospitality Products section)
- Seal begins compressing at 3/8"; compresses to seal up to a 1/16" gap



S88_

AVAILABLE FINISHES: **BL, C, D, GR, TAN, W**
AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 204', 510'**
ANSI: **R0E154, R0E155**

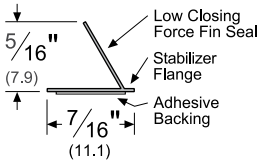
- Seal begins compressing at 1/4"; compresses to seal up to a 1/16" gap
- Available with perforations for Behavioral Health applications. Substitute "P" in place of "S" to order this option.



S44_

AVAILABLE FINISHES: **BL, C, D, GR, W**
AVAILABLE LENGTHS: **17', 18', 20', 21', 25', 30', 204', 510'**
ANSI: **R0E154, R0E155**

- Designed for tighter frames.
- Demonstrates extremely low closing force.
- Seal begins compressing at 5/16"; compresses to seal up to a 1/16" gap
- Available with perforations for Behavioral Health applications. Substitute "P" in place of "S" to order this option.



NOTE: Products shown in this section may not be drawn to scale.
AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
Adhesive Gasketing Colors: **BL** (Black) **C** (Clear) **D** (Dark Brown) **GR** (Light Gray) **TAN** (Tan) **W** (White)

ASSA ABLOY

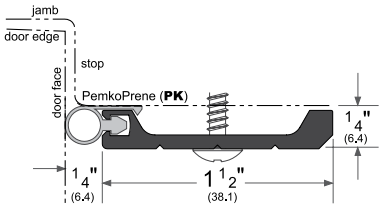
The global leader in door opening solutions

Heavy Duty Perimeter Gasketing - Standard Jamb

- For the head section of the frame where a parallel arm closer bracket or other hardware is required. Supplied undrilled (36") or drilled (80" and above) and supplied with sheet metal screws for mounting
- If used as a stop, flat head machine screws can be provided upon request and take a countersunk #10 hole. PEMKO will drill the head member only if drilling instructions for countersink holes are provided
- All gasketing shown below is sold individually

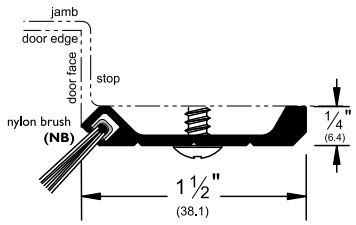
290_PK

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **PK47 (BL, GR)**
ANSI: **R3G164, R3G165**



29045_NB

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **P14050 (BL, GR)**
ANSI: **R3A164, R3A165**



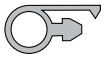
Alternate Inserts For 290

290_S

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **S3 (BL, GR, W)**
ANSI: **R3E164, R3E165**

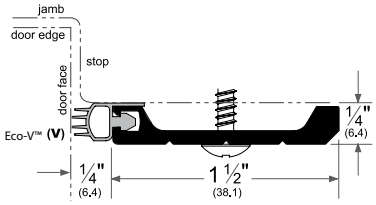
290_V

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **EV47 (BL, GR, W)**



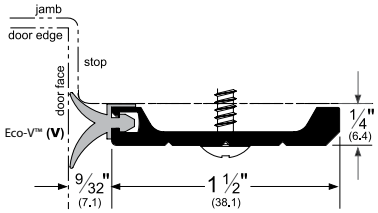
2902_V

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **EV59 (BL, GR, W)**



2903_V

AVAILABLE FINISHES: **A, D, G**
REPLACEMENT INSERT: **EV60 (GR)**

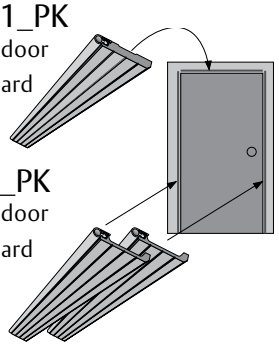


2891_PK

1 per door standard

290_PK

2 per door standard



When ordering a head section such as 2891_PK, two corresponding side sections (i.e. 290_PK) should also be ordered for the latch and hinge sides of the frame.

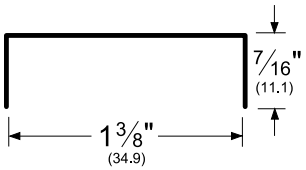
NOTE: Products shown in this section may not be drawn to scale.
AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **D** (Dark Bronze Anodized) **G** (Gold Anodized)

Door Top Weatherstrip

_343

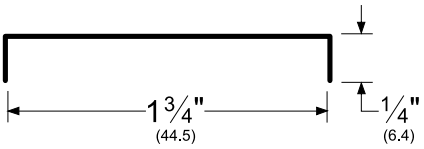
AVAILABLE FINISHES: **PA**
AVAILABLE LENGTHS: **36", 48"**

- For top of 1 3/8" wood doors



_344

AVAILABLE FINISHES: **PA**
AVAILABLE LENGTHS: **36", 48"**



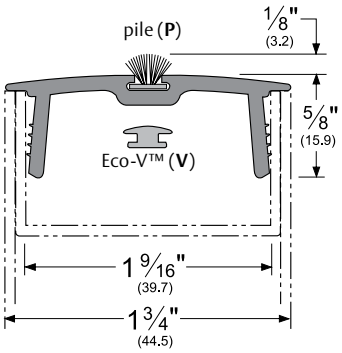
377VP_

REPLACEMENT INSERT: **P2 (BL, GR)**

377V_

REPLACEMENT INSERT: **EV38 (Tan)**

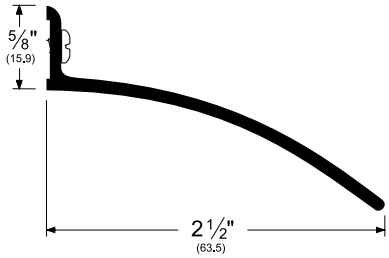
Rigid tan colored Eco-V™ with Eco-V™ (V) insert or pile (P) insert used as a door top (or bottom) filler strip for hollow metal doors



346_

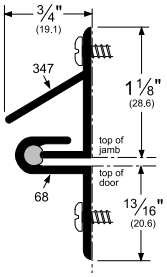
AVAILABLE FINISHES: **C, D, G, PW**

- Overhead rain drip with slotted holes
- Should be ordered a minimum of 4" longer than the door width



347_
68_R

AVAILABLE FINISHES: **A, D, G**



Heavy Duty Door Bumper

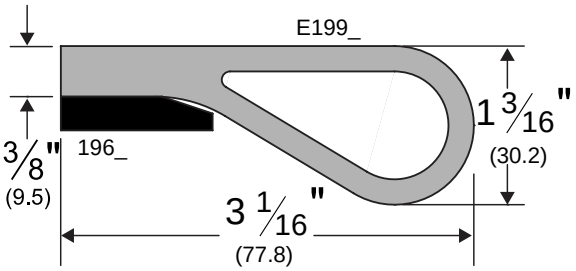
- Heavy duty door bumper extruded from black EPDM (E)
- Order 196_ separately; furnished undrilled unless requested otherwise

E199_

AVAILABLE COLOR: **BL**

196_

AVAILABLE COLOR: **A**



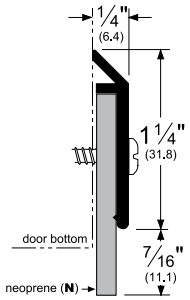
NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
A (Mill Finish Aluminum) **C** (Clear Anodized) **D** (Dark Bronze Anodized) **G** (Gold Anodized) **PA** (Painted Aluminum) **PW** (Painted White)
Non-Metal Finish: **BL** (Black)

Door Bottom Sweeps

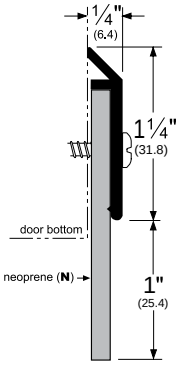
315_N

AVAILABLE FINISHES: **B, C, D, G, PW, SN**
REPLACEMENT INSERT: **N8 (BL, GR)**
ANSI: **R3B434, R3B435**



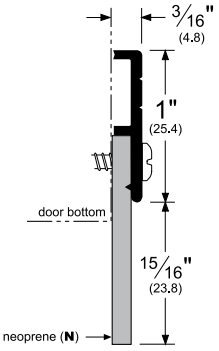
3151_N

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **N9 (BL)**
ANSI: **R3B434**



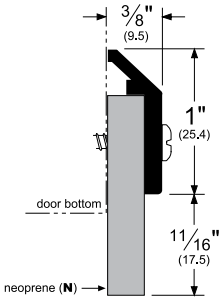
321_N

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **N8 (BL)**
ANSI: **R3B434, R3B435**



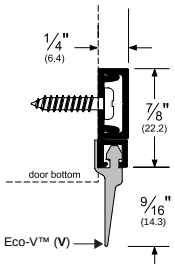
368_N

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **N10 (BL)**
ANSI: **R3B434, R3B435**



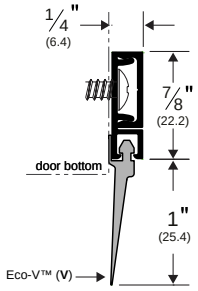
29326_V

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **EV65 (BL, GR, W)**
ANSI: **R3D434**



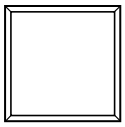
293100_V

AVAILABLE FINISHES: **C, D, G**
REPLACEMENT INSERT: **EV54 (BL, GR, W)**
ANSI: **R3D434**



NOTE: Products shown in this section may not be drawn to scale.

AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)
B (Mill Finish Extruded Bronze [Brass]) **BDG** (Bright Dip Gold Anodized) **C** (Clear Anodized)
D (Dark Bronze Anodized) **G** (Gold Anodized) **PW** (Painted White) **SN** (Satin Nickel Anodized)



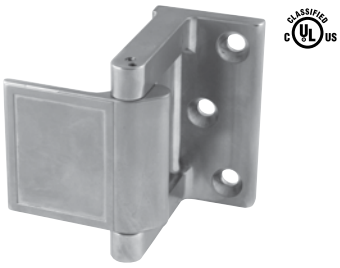
Wall Guard No. 606

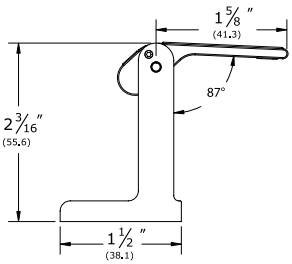
Material: Clear rubber

Other: Sold in sheets of 55

Features: Self-adhesive mounting

No.	Fastener	Size	Weight
606	Self-adhesive back	1"x1"	0.4 lbs./55





Privacy Door Latch No. PDL (formerly 607)

Material: Zinc die cast

Finishes: BRS, DBRS, STNN, CRM, DCRM, ORB

Features:
- ADA compliant
- Enhanced in room privacy
- Easy to install
- For use with UL Classified fire doors for use with hollow metal steel composite type fire doors rated up to and including 3 hrs Wood composite type fire doors rated up to and including 1 1/2 hrs and 20 minutes without hose stream

No.	Fastener	Size	Weight
PDL	#12 x 1 1/4" FH SMS	1 1/2 " x 2 13/16"	0.75 lbs.

Door Silencer No. 608CA

Material: Clear rubber

Other: Sold in packages of 300

Features: Self-adhesive mounting

No.	Fastener	Size	Weight
608CA	3/8" dia. x 1/8"	Metal or wood	0.2 lbs./300

608

609

Door Silencers No. 608, 609

Material: DuraFlex gray rubber

Other: Sold in packages of 100

No.	Size	Frame Type	Weight	ANSI A156.16
608	1/2" dia. x 5/8"	Metal	1.3 lbs./500	L03011
609	3/8" x 3/4"	Wood	1.3 lbs./500	L03021

ASSA ABLOY

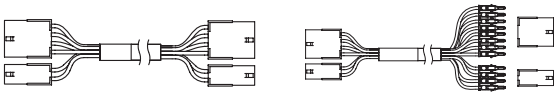
The global leader in door opening solutions

ElectroLynx® Retrofit Cables

If you are not ordering ASSA ABLOY Door Group doors with the ElectroLynx® cable pre-installed in the door, you must order an ElectroLynx® retrofit cable to go between ANY hardware and the hinge. This includes 3" cables to go from the hinge to an exit device and up to a 15' cable to go up and around a full lite metal door.

QC-C1500P Shown

Standard ElectroLynx® Retrofit Cable Sizes



Actual Cable Length	12 Conductor and Molex both ends	12 Conductor and Molex one end, pinned one end	Typical Application
3"	QC-C003	QC-C003P	Between hinge and the end of an exit device.
6"	QC-C006	QC-C006P	
12"	QC-C012	QC-C012P	
26"	QC-C200	QC-C200P	Between hinge and through the door to the lockset or exit device trim.
32"	QC-C206	QC-C206P	
38"	QC-C300	QC-C300P	
44"	QC-C306	QC-C306P	
50"	QC-C400	QC-C400P	
15' 2"	QC-C1500	QC-C1500P	From the hinge location, up the jamb to above the ceiling, or up and around full lite or half lite metal door.
25'	-	QC-C2500P	
30'	-	QC-C3000P	

Custom lengths available.

800-346-7707 | www.assaabloydooraccessories.us
Check the web site for the up-to-date catalog

ACCESS CONTROL »PRODUCTS

SECURITRON®

ASSA ABLOY

ASSA ABLOY, the global leader in door opening solutions

DPS
Door Position Switches

DPS-W and DPS-M door position switches enable access control systems to monitor the open or closed state of a door. These switches can transmit an initiate signal to Securitron's XDT delayed exit logic timers and DPA door prop logic timers.

DPS-W

Concealed Door Position Switch for Wood Doors:

- Mated magnetic switch and cylindrical magnetic contact
- Recesses into door and frame
- 3/4" [19mm] round installation, 15/16" deep
- Provides Normally Closed SPST switch
- Works with door gap up to 3/4" [18mm]
- MagnaCare® lifetime replacement, no fault warranty

PRODUCT OPTIONS

- Available in white, gray or black

DPS-M

Concealed Door Position Switch for Metal Doors:

- Mated magnetic switch and magnetic contact
- Recessed into door and frame
- 3/4" [19mm] round installation, 1/2" deep
- Larger cylindrical magnet counters shielding effect of steel
- Provides Normally Closed SPST switch
- Works with door gap up to 3/4" [18mm]
- MagnaCare® lifetime replacement, no fault warranty

SPECIFICATIONS

Electrical:
Switching Current AC/DC (max): 0.4A

Operating Temperature:
-40 to +150F [-40 to +65C]

MODELS

PART #	Description
DPS-M-BK	DPS for Metal Doors - Black
DPS-M-GY	DPS for Metal Doors - Grey
DPS-M-WH	DPS for Metal Doors - White
DPS-W-BK	DPS for Wood Doors - Black
DPS-W-GY	DPS for Wood Doors - Grey
DPS-W-WH	DPS for Wood Doors - White

LIFE
MAGNACARE WARRANTY

DPA
Door Prop Alarm

The DPA complements door position/door state detection with timed logic and relays that provide escalating alerts when a door is held, propped or unsecure after a defined time period. This unit promotes safety and loss prevention at ancillary exits for healthcare, commercial and retail facilities, and dorms.

PRODUCT FEATURES

- Multi-functional control timer provides relay action for alarms and alerts
- Monitors whether a door remains open after a defined time frame
- Includes three 5A SPDT outputs providing local and remote signaling
- Digital time settings from 30 to 240 seconds
- Detects attempts to tamper with lock or door status
- Multiple time ranges for escalating alerts
- Bypass mode for valid access/ egress needs
- Comes with Piezo sounder and LED
- MagnaCare® lifetime replacement, no fault warranty

SPECIFICATIONS

Electrical:
Max draw 100 mA at 12 VDC
Max draw 50 mA at 24 VDC

Operating Temperature:
+32 to +120F [0 to +49C]

Shipping Weight:
2.05 lbs [0.93kg]

MODELS

PART #	Description
BA-DPA-12	Door Prop Alarm Timer - 12 VDC w/ Boxed Alarm
BA-DPA-24	Door Prop Alarm Timer - 24 VDC w/ Boxed Alarm

LIFE
MAGNACARE WARRANTY

SECURITRON
ASSA ABLOY

POWER
»PRODUCTS

SECURITRON®
ASSA ABLOY

ASSA ABLOY, the global leader in door opening solutions

Securitron® AQD Series

Dual-voltage switching power supplies

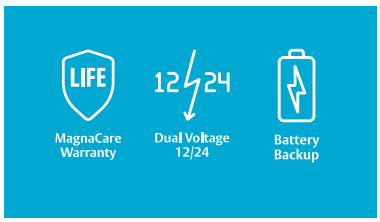
A full line of highly efficient power supplies that protect devices from over voltage.

The Securitron AQD Series of switching power supplies are dual voltage supervised units with a battery charger designed to power magnetic locks, electric strikes, card readers, sensors, access control boards and other devices in access control systems. The Securitron AQD Series can also be used to power DC cameras and other DC locking equipment. These units provide field selectable 12 or 24 VDC with up to 16 independently controlled power limited outputs.

Features

Standard Features

- Dual voltage 12 or 24 VDC field selectable continuous output
- Tolerates brownout or overvoltage input ± 15% of nominal voltage
- Thermal shutdown protection with auto restart
- Circuit breaker protects against overcurrent and reverse battery faults (batteries sold separately)
- Dedicated battery charging circuit prevents overvoltage on locking devices (except AQD1)
- Expandable up to 16 outputs in the standard enclosure
- Outputs are Class 2 limited when used with PTC Polyswitch output distribution boards
- Available with a single relay fire trigger or individually fire trigger relayed outputs
- MagnaCare® lifetime replacement, no-fault, no questions asked warranty
- Low noise design provides better than linear performance
- Mix and match configuration allows for UL compliance even when used in other UL Listed enclosures



Specifications

Certifications

- UL 294 Listed
- UL 603 Listed
- ULC-S318 Listed
- ULC-S533 Listed
- RoHS Compliant
- REACH Compliant

Dimensions

- Enclosure: 14" x 14" x 4-3/4"
  [356mm L x 356mm W x 121mm D]

Electrical

- 12 VDC or 24 VDC field selectable output
- 115 or 230 VAC input*
- Supports up to two (2) sealed gel, AGM or wet lead acid batteries
- Up to 90% efficiency
- Low voltage ripple design as low as 240mV p-p

Environmental

- Operating Temperature: -4˚ to 122˚F [-20˚ to 50˚C]

Shipping Weight

- 12.7 lbs [5.76kg]

**AQD1 115VDC only*

Models

Model	Amperage	Rated Voltage (12 or 24 VDC)	Input Voltage	Typical Voltage	Class 2 Outputs	Replaces
AQD1	1	12 or 24 VDC	115	13.7 / 27.4	Yes	AQD3
AQD2	2	12 or 24 VDC	115/230	12.5 / 25.0	Yes	AQD3
AQD4	4	12 or 24 VDC	115/230	12.5 / 25.0	Yes	AQD5
AQD6	6	12 or 24 VDC	115/230	12.5 / 25.0	Available*	AQD6

** Outputs are class 2 limited when used with 4 or 8 output PTC distribution boards*

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glazing for the Project except as noted below.
2. Glazing accessories.
3. Glazing sealants.

B. Related requirements:

1. Division 08 for framed mirrors.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data for glass, sealants, gaskets and glazing accessories.
B. Samples:

1. Twelve-inch square labeled Samples of each type and color of glass, with taped or ground edges.
2. Coated glass Samples shall show extremes of color range.
3. Glass indicated or required to be “heat-treated” need not be when submitting Samples.

C. Certification: Glass manufacturer’s certification as specified.

1. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements. Include wind pressure analysis, thermal stress analysis, including shading effects, and review of Shop Drawings stating that details are suitable for proposed glass products.
2. Separate certifications are not required for glazing materials bearing the manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

D. Glazing schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass type and thickness for each size opening and location.
E. Preconstruction adhesion and compatibility test report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
F. Product test reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.
4. Monothetic glass
5. Laminated glass.
6. Glazing sealants.
7. Glazing gaskets.

G. Labels: Provide NFRC Rating Labels as required by the California Energy Code. Reference compliance guide for information required.

1.3 QUALITY ASSURANCE

A. Glazier qualifications: Experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Fabricator qualifications: When the glass manufacturer has a certification program, the fabricator shall have a current “Certified Fabricator” certificate form the glass manufacturer.

C. Source limitations for clear glass: Obtain clear float glass from one primary glass manufacturer.

D. Source limitations for tinted glass: Obtain tinted, heat absorbing, and light reducing float glass from one primary glass manufacturer for each tint color indicated.

E. Source limitations for coated glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.

F. Source limitations for insulating glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.

G. Source limitations for glazing accessories: Obtain glazing accessories from one source for each product and installation method indicated.

H. Safety glass:

1. Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
2. Subject to compliance with the above, provide a permanent mark on safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to AHJ.

I. Insulating glass certification program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency.

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. National Accreditation and Management Institute.

J. Mockups: Before glazing, build mockups for each glass product indicated below in accordance with the following requirements, using materials indicated for the completed Work.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Build mockups with the following kinds of glass to match glazing systems required for Project, including typical lite size, framing systems, and glazing methods:

    a. Heat-strengthened coated glass.
    b. Tempered glass.
    c. Coated insulating glass.

3. Obtain Architect's approval of mockups before starting fabrication.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove mockups when directed.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

K. Manufacturer certification: Submit manufacturer certification that.

1. All materials to be used in the glazing system such as sealants, setting blocks, spacers, backing rods, metal finishes, etc. have been reviewed by the glass manufacturer.
2. These materials are compatible with the glass supplied to the Project site.
3. These materials will not cause deterioration, premature aging, and staining of adjacent materials.

L. Labeling:

1. Submit a certificate stating that the glass furnished for the Project complies with the Specifications.
2. Label each piece of heat-treated glass with a permanent logo etched in one corner to identify the fabricator.

1.4 HANDLING

A. Storage: Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, run-off, and other causes.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of bulk sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

1.6 SPECIAL WARRANTIES

A. Warrant insulating glass for 5 years after Substantial Completion against fogging and loss of transparency and frost build-up between the glass panes due to defective materials or sealant failure.

B. Replace defective materials and workmanship during the warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 PRIMARY GLASS MANUFACTURERS

A. Basis of Design: Vitro Architectural Glass (formerly PPG Glass.)
B. Cardinal Glass Benson Global (formally AGC Flat Glass North America Ltd.)
C. Guardian Glass.
D. Pilkington Group.
E. Or equal.

2.2 CRITERIA AND PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
B. Glass design: Glass thicknesses shown and heat treatment specified are minimum requirements based upon manufacturer's regularly published literature. The Architect makes no representations as to the accuracy of the literature or the conclusions derived therefrom.. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thickness and

in strengths (annealed or heat-treated) required to meet or exceed the criteria specified below and ASTM E 1300.

C. Glass thickness and temper indicated have not been engineered. Design glass, including comprehensive engineering analysis according to the CBC by a qualified professional engineer under the Contractor's employ, using the following design criteria.

1. Design wind pressures:

   a. Positive: As indicated on structural Drawings. If not indicated, comply with ASCE/SEI "Minimum Design Loads for Buildings and Other Structures," unless otherwise prescribed by Code.
   b. Negative: 20 psf, unless otherwise indicated.

2. Vertical glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
3. Sloped glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads.

   a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.

4. Probability of breakage for glass surfaces sloped less than 15 degrees from vertical: Design glass for a probability of breakage not greater than 0.008.
5. Probability of breakage for glass surfaces sloped more than 15 degrees from vertical: Design glass for a probability of breakage not greater than 0.001.
6. Maximum lateral deflection: For glass supported on all 4 edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or one-inch, whichever is less.
7. Differential shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Thermal movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal and optical performance properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

   a. For monolithic glass lites, properties are based on units with lites 6 mm thick.]For insulating glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch wide interspace.
   c. Center of glass U values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq.-foot by hour by -degree F.
   d. Center of glass solar heat gain coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
   e. Solar optical properties: NFRC 300.

2.3 GLASS MATERIALS

A. General:

1. Annealed Float glass: Shall comply with ASTM C 1036; glass shall comply with ASTM A 1048.

2. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

    a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
    b. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Criteria and Performance Requirements" Article.
    c. For uncoated glass, comply with requirements for Condition A.
    d. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
    e. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required.

3. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings
4. ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
5. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications Method of Test.
6. US Consumer Product Safety Commission CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials
7. Provide glass free from bubbles, smoke vanes, air holes, scratches and other defects.
8. Laminated glass shall comply with ASTM C 1172. Glass in the lamination shall be from the same manufacturer when heat-strengthened.
9. The same manufacturer shall make all tinted and reflective glass.
10. Fabricate tempered glass by horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
11. Comply with Code and the Drawings for glass in hazardous locations. Laminated glass subject to human impact shall comply with CPSC 16 CFR Part 1201.
12. Unless otherwise indicated or specified, overall thickness of each glass type and composite thickness of multiple layer glass types shall be consistent throughout the Project.
13. Provide insulating glass assemblies CBA rated by IGCC when tested in compliance with ASTM E 774, and permanently labeled with the appropriate certification label of IGCC, ALI or NCTL.

2.4 GLAZING MATERIALS

A. Setting block: Neoprene or, in the case of structural silicone glazing, dense extruded silicone; both with a hardness of 80 to 90 durometer Shore A with a minimum length of 4-inch or as required by GANA guidelines. For flush glazed skylights, provide L shaped setting blocks.
B. Side blocks: Neoprene or dense silicone with a hardness of 65 ±5 durometer Shore A.
C. Spacer: Neoprene, silicone, or EPDM, 50 to 60 durometer hardness, compatible with sealants used.
D. Sealants:

1. For structural glazing: High modulus (structural) silicone sealant, 2-component, non-acidic, neutral curing silicone which meets or exceeds Federal Specification TT-S-00227, Type II, Class B and ASTM C920, Type M, NS, Class 12.5.

    a. Color: As selected by Architect.
    b. Acceptable products:

1) Dowsil “995” or “DC 995.” DC 983 is not acceptable for use with painted substrate without incorporation of special substrate preparation requirements utilizing Scotch Brite pads, alcohol and barrier primer.
2) Dowsil “999” (Glass Mullion Glazing System only).
3) General Electric “Ultra Glaze SSG 4400” and “Ultra Glaze 4000.”
4) Tremco “Proglaze SSG.”
5) Pecora “895” or 2-part “Fast Cure.”

c. Painted surfaces in contact with structural silicone must be primed with a primer approved for use by the sealant manufacturer.

2. For primary seal of insulating units: Manufacturer standard sealant.
3. For all other conditions: Medium and low modulus (weatherseal) silicone sealant, one-part, non acidic, neutral curing, Type S, Grade NS, Class 25, Use NT, capable of withstanding movements from plus 50 to minus 50 for medium modulus and plus 100 to minus 50 percent for low modulus based on original joint design.

a. Color: Match Architect’s paint color for sealant.
b. Acceptable products:

1) Dowsil “795” and “790.”
2) General Electric “Silpruf,” “Silpruf LM.”

c. Only low modulus sealant, such as Dowsil “790” or GE “Silpruf LM,” shall be used when sealing to cementitious substrate.

E. Glazing gasket: Resilient, continuous neoprene, (except as specified below) extrusions, 40 to 60 Shore A durometer hardness, meeting the requirements of ASTM C 509 for cellular (closed-cell) material, and AAMA SG-1 for non-cellular (dense) material, with molded corners.

1. Gaskets shall have a continuous mechanical engagement to framing members and factory molded corners.
2. Gasket corners, whether molded or not, shall be bedded in elastomeric sealant compatible with glazing gaskets.
3. When in direct contact with silicone sealants, gaskets, spacers and setting blocks shall be heat cured silicone rubber based material chemically compatible with the silicone sealant and with sufficient hardness for the specific purpose intended. Compatibility testing by the silicone sealant supplier/manufacturer shall be required.
4. Design interior and exterior gasket profiles to produce a glass edge pressure of 12 psf unless otherwise recommended by the glass manufacturer.

F. Compressible filler rod:

1. Closed-cell or waterproof jacketed rod stock of synthetic rubber or plastic foam compatible with sealants used, flexible and resilient, with 5 to 10 psi compressive strength at 25 percent deflection.
2. Do not use vinyl foam stock.

G. Laminated Glass Interlayer:

1. Construction: Laminate glass with Ionoplast polymer interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

H. Glass coating for sandblasted surfaces: CLO Ritec “ClearShield Coating" by CLO Glass Ltd.
I. Cleaner, primer and sealer: Type recommended by sealant or gasket manufacturer.
J. Partition closure: Michael Rizza Co., LLC “Partition Closures” consisting of an extruded aluminum retainer channel and a compressible solid silicone closure.
K. Sealer for acid-etched and sandblasted glass: Etch Sealer by Skyline (773.278.4660), or equal wax-free, specially formulated sealer to resist fingerprints and stains.

2.5 FABRICATION

A. Cutting:

1. Obtain sizes from Shop Drawings or by field measurement. Cut glass to fit each opening with at least the minimum edge clearance and bite on glass recommended by glass manufacturer.
2. When glass will be precut to sizes obtained from Shop Drawings, take field measurements of each opening before glazing to verify adequate bite on glass and minimum edge clearance.
3. Glaze openings, which do not fall within tolerances for which precut glass has been sized only with glass specially cut to fit such openings.
4. Do not nip glass edges. Edges may be wheel cut or sawed and seamed at manufacturer's option.

B. Edge quality of annealed and heat-strengthened glass:

1. Shark teeth shall not penetrate more than half of glass thickness.
2. Serration hackle shall not penetrate more than 10 percent of glass thickness.
3. Flare shall not exceed 0.062-inch as measured perpendicular to glass surface edge.
4. Bevel shall not exceed 0.062-inch.
5. Flake chip depth shall not exceed 0.031-inch and length or diameter shall not exceed 0.25-inch.
6. Rough chips are not permitted. Rough chips are those that exceed dimensional limits for flake chips.
7. For glass to be cut at site, provide glass 2-inch larger than required, in both dimensions, to facilitate cutting of clean-cut edges without seaming or nipping.
8. Do not cut, seam, nip, or abrade tempered and heat strengthened glass after tempering.
9. Provide flat ground edges with arised corners where glass edge is not covered by a metal stop.

C. When full height vision glass is shown (without intermediate horizontals or rails), safety glazing is only required on the inboard lite for Code compliance except on the ground floor or other areas where there is a walking surface on both sides. Alternately, if an aluminum rail is used on the interior of the framing, neither lite need not be safety glazing.
D. Glass in sloped glazing conditions (15 degrees or more from vertical) shall be laminated with both lites heat-strengthened. Fully tempered glass is not allowed, whether monolithic, laminated, or as the inboard lite of an insulated glass unit.
E. Insulating glass:

1. Provide black aluminum spacers with bent (not mitered or spliced) corners; only one seam is allowed in each spacer of each unit.
2. The date of the manufacture of the unit shall be discretely identified on the spacer (top of unit, left or right corner).

F. Identification: Identify tempered glass with a manufacturer-installed, removable paper designation as required by CBC section 2406.

G. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 2188 / E 2189 for and with requirements specified in this Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Comply with requirements in Section 07920 - Joint Sealants. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

a. Spacer Material: Aluminum with mill or clear anodic finish.
b. Desiccant: Molecular sieve or silica gel, or blend of both.
c. Corner Construction: Manufacturer's standard corner construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Verify that openings and frames to be glazed are within allowable tolerances, plumb, level and square.
C. Inspect framing joint intersections to ensure that the offset in the joinery will not impose undue edge pressure on the glass in compliance with GANA, Glazing Manual, and Sealant Manual, guidelines.
D. Correct other detrimental conditions before proceeding with glazing.

3.2 STANDARDS AND PERFORMANCE

A. Watertight and airtight installation is required for each piece of glass installed in an exterior wall and skylight.
B. Each installation must withstand normal temperature changes, wind loading, and impact from normal operation for doors and windows, without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.
C. Installed glass shall be free from rattle.
D. Protect glass from damage at all times during handling, installation and operation of the building until Substantial Completion.
E. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are specified.
F. Except as recommended otherwise by the manufacturers of the glass and glazing materials, comply with GANA Glazing Manual and the following:

1. Provide minimum nominal glass bite of 0.375-inch on monolithic lites; 1/2-inch on insulated glass units.
2. Where joint movement will result in variable glass bite, increase nominal bit to provide 0.375-inch minimum bite and 0.25-inch minimum edge clearance.

G. Inspect each piece of glass immediately before installation, and eliminate those with edge damage or face imperfections.
H. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.

3.3 PREPARATION FOR GLAZING

A. Immediately before glazing, clean the glazing channel and other framing members to receive glass.

1. Remove coatings not firmly bonded to the substrate.
2. Verify that framing is satisfactory to receive the glass.

B. Apply primer or sealer to joint surfaces when recommended by sealant manufacturer.

3.4 GLASS INSTALLATION

A. Structural glazing: Comply with the sealant manufacturer's instructions and the following ASTM standards.

1. C 794: Sealant compatibility and adhesion to each substrate to be encountered on the Project.
2. C 1087: Sealant compatibility with backing.
3. C 1087: Sealant compatibility and lack of adhesion to bond breaker.
4. C 1184: Structural Glazing Specifications.
5. C 1401: Guide for Structural Glazing.

B. Erect each pane of glass square, plumb, and with uniform clearances between panel and rebates.
C. Follow glass manufacturer's instructions and GANA Standards. Maintain minimum bed clearance between glass and frame.
D. Do not nip glass. Do not install glass with edge damage.
E. Install glass with required glass markings right side up so they can be read from the exterior.
F. Setting blocks:

1. Minimum length of 4 inches or as required by GANA guidelines; minimum width shall correspond to the glass thickness and retaining member but, in no case less than the glass thickness at point of contact.
2. Locate at quarter points, or in accordance with GANA glazing guidelines.
3. Secure against migration.
4. Shims used in conjunction with setting blocks must be of the same material, hardness, length and width as the setting blocks.

G. Side blocks:

1. Locate side blocks where required within the upper half of each jamb for each light.
2. Install block with 1/8-inch clearance between block and glass bearing surface.
3. Block shall be sufficient length to prevent point loading on the glass.
4. Side blocks are not required where an individual glass light is continuously sealed with silicone at 2 or more edges, when the sealant is installed immediately following the setting of the glass.

H. Provide spacers inside and out unless continuous gaskets are used. Use glass manufacturer recommended size and spacing.

I. Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels, except as needed for drainage and weep holes) depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.
J. Sealant shall not be adhered to, or placed against, the edge of a laminated glass unit interlayer.
K. Force sealants into channel to eliminate voids and to assure complete "wetting" or bond of sealant to glass and channel surfaces.
L. Tool exposed surfaces of sealants to provide a substantial "wash away" from the glass.
M. Install pressurized gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
N. Clean and trim excess glazing materials from the glass, stops and frames promptly after installation, and eliminate stains and discolorations.
O. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement.

1. Anchor gasket to stop with matching ribs, or with adhesive.

P. Clean, prime and mask structural silicone joints the same day when silicone is applied.

3.5 MIRROR INSTALLATION

A. See Section 08 86 00.

3.6 CURING/PROTECTING/CLEANING

A. Cure glazing sealants and compounds in compliance with their manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
B. Protect glass from breakage immediately upon installation. Do not apply markers of any type to glass.
C. Before Substantial Completion, remove and replace glass that is broken, chipped, cracked, abraded, stained or damaged in other way, including natural causes, accidents and vandalism.
D. Maintain glass in a clean condition during construction so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.
E. Remove remaining labels and wash and polish glass on both faces not more than 4 days prior to Owner's acceptance of the work in each area. Comply with GANA 01-0300 and the glass manufacturer's recommendations.

3.7 GLASS SCHEDULE

A. See Exterior Elevations on Architectural Drawings.
B. Type GL-1: Low-E Tinted Insulating Glass - Light sky-blue, low-reflective exterior appearance:

1. Solarban 70XL (2) Solarblue + Clear by Vitro Architectural Glass.
2. Performance Values: VLT 42 percent; SHGC 0.23; shading coefficient 0.26; exterior reflectance 8 percent; U-value winter 0.28; U-value summer 0.26.
3. Insulating Glass Unit Construction: 1/4 inch (6 mm) Solarblue glass, Solarban 70 solar control (sputtered) on second surface (2) + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Clear glass.
4. Overall Unit Thickness: 1 inch.
5. Outdoor Lite: fully tempered float glass.
6. Interspace Content: Argon.
7. Indoor Lite: annealed fully tempered float glass.

C. GL-2: Low-E Tinted Insulating Glass - Light sky-blue, low-reflective translucent exterior appearance:

1. Solarban 70XL (2) Solarblue + translucent glass lite by Vitro Architectural Glass.
2. Insulating Glass Unit Construction: 1/4-inch (6 mm) Solarblue glass, Solarban 70 solar control (sputtered) on second surface (2) + 1/2-inch (13 mm) air space + 1/4 inch (6 mm) translucent glass.
3. Overall Unit Thickness: 1 inch.
4. Outdoor Lite: fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: annealed fully tempered translucent float glass.

D. GL-3: Low-E Tinted Insulating Glass - Light sky-blue, low-reflective translucent exterior appearance:

1. Solarban 70XL (2) Solarblue + translucent glass lite by Vitro Architectural Glass.
2. Insulating Glass Unit Construction: 1/4-inch (6 mm) Solarblue glass, Solarban 70 solar control (sputtered) on second surface (2) + 1/2-inch (13 mm) air space + 1/4 inch (6 mm) translucent glass.
3. Overall Unit Thickness: 1 inch.
4. Outdoor Lite: fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: annealed fully tempered translucent float glass.

E. GL-4: Tempered, two-ply laminated clear tempered glass with Ionoplast polymer interlayer.

1. Location: Glass rails.

F. GL-5: Monothetic low-iron glass clear tempered glass.

1. Overall Unit Thickness: 1/4-inch.
2. Location: Interior glass doors.

G. GL-6: See Section 08 86 00 for unframed mirrors.

END OF SECTION

SECTION 08 86 00 - MIRRORED GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Unframed mirrors (GL-6).
2. Adhesives, sealers and accessories.

B. Related requirements: Section 10 28 00 for framed mirrors.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Pre-installation meeting:

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for mirrors, sealers, adhesive, and trim.
B. Samples: 6-inch square, with finished edges.

1.4 QUALITY ASSURANCE

A. Label back of each mirror as required by ASTM C 1503.

1.5 SPECIAL WARRANTY

A. Warrant mirrors against silver spoilage for 5 years after Substantial Completion.
B. Replace defective materials and workmanship during the warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MIRRORS

A. General:

1. Glass shall comply with ASTM C 1036.
2. Mirrors shall comply with ASTM C 1503.

A. Mirrors: See GL-6 on sheet A610 -Interior Finish Materials sheet.

1. Tempered clear glass mirrors: Comply with ASTM C 1503, Mirror Glazing Quality, for blemish requirements in annealed float glass before silver coating is applied, for coating requirements, and with other requirements not affected by tempering process; and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied. Nominal Thickness 6.0 mm.
2. Nominal thickness: 6.0 mm unless indicated otherwise.

2.2 MISCELLANEOUS GLAZING MATERIALS

A. Adhesive: Mirror Mastic by Palmer, Ultra/Bond by C. Gunther Co. or Titebond Fast Set Polyurethane Construction Adhesive.
B. Backing and cut edge sealer: Primary Mirror Backing by CR Lawrence, Mirro-Bac by Palmer, Seal-Kwik by C. Gunther Co., or equal by Lilly Industries or Peacock Laboratories.
C. J moldings: Polished chrome (US 26) finished "J" moldings model 541 by JW Goss Co. or equal by CR Lawrence Co., Trident Consolidated Industries or A. Geo Diack.
D. Edge sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

2.3 FABRICATION

A. Obtain sizes from Shop Drawings or by field measurement.
B. Precut mirrors to sizes obtained from Shop Drawings, take field measurements before cutting. Fabricate mirrors in one piece for each toilet room, except as otherwise authorized by the Architect due to mirror size.
C. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
D. Edge treatment:

1. Do not nip edges. Edges may be wheel cut or sawed and seamed at manufacturer's option.
2. Grind and polish exposed edges.
3. Edges when concealed by a continuous channel may be clean cut.
4. Seal edges of mirrors after edge treatment or require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. When laminating directly to gypsum board, verify that gypsum board is sealed with an acrylic sealer prior to installing mirrors.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Apply one additional coat of mirror backing to the back of the mirror, allow the backing to dry, and then apply mirror mastic in compliance with the mastic manufacturer's instructions.
B. Fasten the J-channels to the studs. Level and countersink the fastener heads so they do not contact the mirror backing. Shim the J-channels where depressions in the wall occur so the mirror will be centered in the channel without distortion.
C. Tape the screw heads and the wall edge of the J-channel if it protrudes from the wall.
D. Place setting blocks at 2 locations for each mirror in the lower J-channel, approximately 6 inches from edges.
E. Paint the seam line of the mirror butt joint black to prevent the white wall from showing through the seams if applicable.
F. Dry fit each mirror to assure a secure fit. Adjust the setting blocks if necessary. Verify that mirror edges are sealed before installing to avoid black edge problems.
G. Apply mastic to the mirror according to the mastic manufacturer’s instructions by pats, a minimum of one per square foot and a maximum of 4. Compensate at the depressions and bows in the wall to make the installation flat.

H. Install the mirror with vacuum cups. Set the top of the mirror inside the upper J-channel and drop in the lower J channels on the setting blocks.
I. Leave open space of 1/8-inch or more between mirror and substrate. Do not seal ventilation space at edges of mirror.

3.3 CURING/PROTECTING/CLEANING

A. Protect mirrors from breakage immediately upon installation.
B. Maintain mirrors in a clean condition during construction.
C. Do not permit edges of mirrors to be exposed to standing water.
D. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
E. Remove remaining labels and wash and polish mirrors not more than 4 days prior to Owner's acceptance of the work in each area. Comply with GANA MD 01-0105 and mirror manufacturer's recommendations.
F. Before Substantial Completion, remove and replace mirrors which are broken, chipped, cracked, abraded, stained or damaged in other way, including natural causes, accidents and vandalism.

END OF SECTION

DIVISION 09
FINISHES

SECTION 09 05 16 - WATER VAPOR EMISSION CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes system for the reduction of moisture vapor transmission and alkalinity control for Interior concrete slabs.

1.2 SUBMITTALS

A. Submit the following product data:

1. Manufacturer’s Specification.
2. Installation Instructions.
3. Independent Test Data.
4. Certification Requirements.
5. Warranty Information.

B. Test results: Submit anhydrous calcium chloride testing according to ASTM F 1869 and/or RH Probe Test according to ASTM F 2170 from independent testing agency.

1.3 QUALITY ASSURANCE

A. Manufacturer qualifications: Firm with not less than 10 years experience in manufacturing water vapor reduction systems.

1. The water vapor reduction system must be specifically formulated and marketed for water vapor reduction and alkalinity control without change of system design for a minimum period of five (5) years.
2. Submit list of product use and performance history, for the same formulation and system design, listing reference sources for at least 3 projects dating back for a minimum of 5 years.

B. Applicator qualifications: Entity currently approved by the manufacturer, experienced in surface preparation and application of the material and subject to inspection of the manufacturer.

C. Independent testing: Manufacturer must provide Independent lab test reports documenting performance per the following:

1. ASTM E 96, Water Vapor Transmission (wet method) Performance shall be documented by an independent testing laboratory at a minimum of 97% water vapor transmission reduction compared to untreated concrete.
2. ASTM E96- Perm Rating - Standard Test Method for Water Vapor Transmission of Materials – Perm Rate results must not exceed 0.1 Perms.
3. ASTM D 1308; Insensitivity to alkaline environment up to, and including, pH 14. A 14 day test is required with no degradation of sample reported.
4. Certify acceptance and exposure to continuous topical water exposure after final cure.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F.
C. Handle product in a manner that will prevent breakage of containers and damage products.

1.5 PROJECT/SITE CONDITIONS

A. Environmental conditions

1. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
2. Do not apply water vapor reduction system when temperature is lower than 50 degrees F or expected to fall below this temperature within 24 hours from time of application.

B. Protection: Protect water vapor reduction system to prevent damage from active rain or topical water for a minimum period of 24 hours from time of application.

1.6 SCHEDULING

A. Before installation of VCT, sheet vinyl, rubber flooring, wood, carpet and/or epoxy flooring systems over the interior concrete slabs, anhydrous calcium chloride testing ASTM F 1869 (latest revision) and/or RH Probe Tests ASTM F 2170 shall be performed by the Owner's Special Inspector as outlined In Article 3.1 below.
B. The Owner's Special Inspector will coordinate with the Owner scheduling water vapor reduction system testing and allowing enough time to test, submit and install the water vapor reduction system before installation of floor finish.
C. The Owner's Special Inspector will allow for as much time as is reasonable for the concrete slab to dry before installing anhydrous calcium chloride tests and/or RH Probe Tests. All mastics, glues, and/or contaminants shall be removed to provide a clean, sound, concrete substrate prior to installing anhydrous calcium chloride tests as per ASTM F 1869 (latest revision).
D. The water vapor reduction system must allow installation as early as 7 days after concrete placement.

1.7 WARRANTY

A. Provide manufacturer’s warranty against defects in materials and workmanship for 10 years from Substantial Completion.
B. Correct failures during the warranty period at no cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Water vapor reduction system, which may be incorporated in the work, shall be the product of a single manufacturer.

1. VAP I® 2000 System by KOSTER American Corporation;

2.2 MATERIALS

A. General: Use materials of one manufacturer throughout the project.
B. Koster “VAP I 2000”, 100 percent solids epoxy coating, containing specifically formulated chemicals and resins to provide the following characteristics and properties in a one coat system, complying with the following:

1. Minimum 97 percent water vapor transmission reduction compared to untreated concrete, ASTM E 96, Water Vapor Transmission (wet methods).
2. Not exceeding one perm rating, ASTM E 96 Perm Rating.
3. Insensitivity to alkaline environment up to, and including, pH 14 in a 14-day bath test, ASTM D 1308.
4. Certified acceptance and exposure to continuous topical water exposure after final cure.
5. Water Vapor reduction system shall be a single coat, stand alone system with no requirements for additional components such as sand broadcast for adhesion of flooring systems.
6. Reduce Calcium Chloride readings of up to 25lbs/1000 ft2/24 hrs by 97 percent in one coat.
7. Perform as required with RH Probe readings of 100 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Calcium Chloride and/or RH Probe test requirements:

1. Conduct anhydrous calcium chloride tests according ASTM F 1869 protocols.
2. Provide RH Probe Tests according to ASTM F 2170 protocols.
3. Only conduct calcium chloride tests at the same temperature and humidity expected during normal use. If this is not possible, then the test conditions should be 75 degrees F +/-10 degrees F and 50+/-10 percent relative humidity. Maintain these conditions 48 hours prior to and during testing. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature are not acceptable.
4. Submit test results with a marked up floor finish plan showing test results along with a written clarification on status of the ambient air temperature and humidity before start of testing.

B. Concrete Slab Inspection:

1. Test existing slabs (primarily), for concrete deficiencies and contaminates such as un-reacted water-soluble silicates, chlorides, A.S.R. (alkali-silica reaction), to avoid bonding issues. This testing shall be performed by Owner’s independent testing agency using standard coring methods and review of the history of the slab installation if available. Concrete shall conform to ACI Committee 201 Report “Guide to Durable Concrete.”

C. Floor treatment calcium chloride tests: After proper cure (>72 hrs min.) of the moisture vapor reduction system, conduct calcium chloride tests to determine if the level of water vapor transmission and alkalinity are reduced to the Owner's specified levels in conjunction with the flooring manufacturer’s installation requirements.
D. Adhesion tests: Verify proper adhesion of flooring adhesives, coatings, and leveling compounds to the final vapor reduction coating system for acceptability.

3.2 PREPARATION

A. Inspect all surfaces with regard to their suitability to receive moisture vapor reduction system with manufacturer's representative.
B. Clean all surfaces to receive moisture vapor reduction system. Shot blast all floors to a Concrete Surface Profile (CSP) #3 or #4 and clean surfaces with an industrial vacuum cleaner and remove all residues from the substrate. Grinding is allowed only in areas not accessible by shot blasting. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, Shot blast bee bees. Repair cracks, expansion joints, control joints, and open surface honeycombs and fill in accordance with vapor reduction manufacturer's recommendations. If concrete additives such as chlorides or any other soluble compounds that may contaminate surfaces have been used in the concrete mix do not use this product on that floor without written approval from the vapor reduction system manufacturer. Reinforcing fibers that are visible after shot blasting must be removed and vacuumed leaving no fibers left on the concrete surfaces. Provide an uncontaminated, sound surface. Do not acid-etch.
C. Repair concrete prior to vapor reduction system installation by using system manufacturer-recommended bonding agent with approved concrete repair materials. Comply with all requirements as listed in vapor reduction manufacturer's technical data information.
D. Ensure surfaces to be treated with moisture vapor reduction system have not previously been treated with other materials such as underlayments, screeds, penetrating sealants, or silicates. If this is the case, consult with the manufacturer prior to any application of moisture vapor reduction system.
E. Testing for concrete deficiencies or contamination such as alkali silica reaction, untreated silicates, or organic residue is recommended.
F. Shot blast a small test area and inspect surface profile with the finished flooring applicator. As the specified vapor reduction system is not a leveling material, make sure the flooring installer is aware that a feather finish or leveling material may be required to "flatten" or level the vapor reduction-treated concrete prior to flooring installation.

3.3 APPLICATION

A. Coverage rates depend on the surface profile and porosity of the concrete substrate as well as the measured level of moisture. On average, a coverage rate of 75-150 ft2/gal.
B. Apply one coat, using a squeegee and or 3/8 inch nap roller leaving no areas untreated. Allow to cure a minimum of 12 hours before installing flooring system.

3.4 PROTECTION

A. Protect each coat during specified cure period from traffic, topical water and contaminants.

END OF SECTION

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-structural metal framing (NSMF) as follows:

1. Interior steel studs and furring.
2. Shaftwall framing.
3. Pocket door framing.
4. Horizontal steel suspension systems for support of lath/plaster and gypsum board assemblies.
5. Resilient sound clips.
6. Resilient channels.
7. Backing plates not provided by other trades for support of items attached to metal framing system.

B. Work installed but furnished in other Sections:

1. Access panels furnished by electrical and mechanical trades for access to their work.
2. Backing plates furnished with fixtures and equipment attached to, or supported by metal framing system.

C. Related requirements:

1. Division 05 for cold-formed steel framing (exterior walls).
2. Division 09 for gypsum board shaftwall systems.
3. Division 09 for ceiling and soffit suspension systems.

1.2 REFERENCES

A. Lath and plaster framing: Specifications for Metal Lathing and Furring, and Specification Guide For Cold-Formed Lightweight Steel Framing published by the Steel Studs Manufacturers Association.
B. Gypsum board framing: ASTM C 754, Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board or Water-Resistant Backing Board.
C. Welding: AWS D1.1, Structural Welding Code, Steel, and D1.3, Structural Welding Code, Sheet Steel.
D. Studs and runners:

1. ASTM C 955, Specifications for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
2. ASTM C 645, Specifications for Non-Load (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-construction meeting: Prior to starting erection of the NSMF, but not later than one week prior to commencing work, arrange a preliminary meeting with trades associated with the work of this Section.

1. Presided over by Contractor, include subcontractor performing work of this Section, testing company representative, as appropriate, and a representative of the Fire Marshall.
2. Review locations of access panels, fire hose cabinets and fire extinguisher cabinets; the latter with a representative of the Fire Marshall.
3. Identify those locations on the slab. Use a removable marker where the slab is scheduled to remain exposed in the Work.
4. Review installation methods, procedures, time schedule and conditions under which work will proceed, including stud manufacturer's instructions and coordination required with related work.
5. Review and verify availability of materials and installer’s experience.
6. Record meeting minutes and distribute PDF copy to all concerned, including the Architect, within 48 hours of the meeting.

B. Coordination:

1. Notify concerned trades of items required to be incorporated into work of other Sections. Certain components specified under this Section includes items which are closely integrated with doors, glazing assemblies and work specified in other Sections that require close coordination with the work of this Section.
2. Be responsible for coordination required to ensure correct installation procedures and results.
3. Verify actual locations of embeds and existing adjacent structural supports by field measurements before erection and indicate measurements on Shop Drawings. Coordinate tolerances of other trades that may affect the work of this Section prior to start of Shop Drawings preparation.

1.4 SUBMITTALS

A. Data: Manufacturer Product Data consisting of a complete list of materials together with brochures and descriptive data of all items proposed for use.
B. Load tables: Load tables and deflection table properly annotated for anticipated use for all studs.
C. Shop Drawings: Large scale, dimensioned Shop Drawings of all assemblies showing the following.

1. Component details, framing layout, framed openings, anchorage to structure, seismic bracing, type, and location of fasteners and welds, and accessories required of related requirements.
2. Framing member size and gage designations, number, type, location, and spacing.
3. Indicate attachments, clips, strapping, bracing, splices, bridging, accessories, and details required for proper installation. Show and dimension all concealed backing plates required for wall-attached or wall-mounted items indicated; obtain dimensions from trades that will provide these items.
4. Indicate and identify all fasteners and welds (with AWS symbols).

D. Certificates:

1. Mill certificates signed by framing member/accessory manufacturer certifying compliance with material requirements.
2. Welders' certificates.

E. Delegated design submittals:

1. Calculations signed and sealed by a California-licensed professional engineer, to demonstrate Code compliance for Contractor engineered assemblies.
2. Calculations shall be legible and shall incorporate sufficient cross references to Shop Drawings to make calculations readily understandable and reviewable. Test reports are an acceptable substitute for calculations for the anchors only. Calculations shall include the following:

   a. Analysis of framing members.
   b. Analysis of anchors, including anchors embedded in concrete.
   c. Section property computations for framing members.

3. Seal and signature of design engineer.

F. LEED - Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

1. Include statement indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

A. Engineering responsibilities:

1. Certain metal assemblies require deferred approval (they are design/build). These assemblies are not fully detailed on the Drawings which indicate desired profile and design intent.
2. It is the Contractor's responsibility to engineer, fabricate and install these assemblies to conform to the profiles indicated and other requirements of the Contract Documents, and to satisfy applicable Code. If required by the AHJ, obtain their approval and pay fees incurred thereby before start of installation.
3. Limit metal framing systems deflection under load to the following:

   a. L/240 where supporting gypsum board only.
   b. L/360 where supporting plaster or ceramic tile.
   c. L/600 where supporting stone and other rigid materials subject to breakage.

B. Fire resistance: Where a fire resistance classification is indicated, provide materials, accessories, and application procedures listed by UL, or tested according to ASTM E 119 for the type of construction shown, and acceptable to authorities having jurisdiction.

C. Welding work qualifications:

1. Qualify welding procedures and welding operators in compliance with AWS "Qualification" requirements for AWS D1.3.
2. Use qualified welders experienced in welding light gage steel, and comply with AWS D1.1 and D1.3.
3. Verify that welders to be employed in this work have satisfactorily passed AWS qualification tests.
4. If recertification of welders is required, retesting will be Contractor's responsibility.

1.6 HANDLING

A. Store materials under cover, off the ground or floor, in a dry, ventilated space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: One of the following systems of the size indicated and gage required to comply with criteria specified.

B. Shaftwalls:

1. ClarkDietrich Building Systems.
2. Marino\Ware.
3. USG J-runners, E and C-H studs.
4. SCAFCO Corp. Shaftwall Studs.

C. Elsewhere:

1. CEMCO.
2. ClarkDietrich Building Systems.
3. Marino\Ware.
4. SCAFCO Corp.

2.2 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, NSMF requires deferred submittal (design/build). The Contractor is required to design, within the dimensional parameters indicated, engineer and install the NSMF assemblies to withstand the following loads, applied perpendicular to walls at the point of largest deflection, within the specified deflection limits.

1. At stairs, elevator hoistways, and other vertical shafts: 10 psf.
2. At ground floor lobbies opening to the outside: 15 psf.
3. At partitions to receive stone cladding and lath and plaster: 15 psf.
4. Elsewhere: 5 psf.

2.3 STUDS, RUNNERS AND FURRING

A. Studs:

1. Shaftwalls: As specified above.
2. For low (Pony) walls: Scafco Corp. “Pony Walls” assemblies, or equal.
3. Elsewhere: Channel type cold-formed steel members with punched web, complying with the following, as applicable.

a. Roll-formed from galvanized steel meeting ASTM A 653, Classification SQ, Grade 33; galvanized meeting G60 for 18-gage and lighter gage.
b. For 16-gage and heavier, provide ASTM A 653, Classification SQ, Grade 50; galvanized meeting G60.
c. Protective coating: ASTM A 653, G40 zinc coating.
d. Bracing: Where the wall finish does not adequately brace both flanges of studs, add bracing or reduce allowable stresses in computing stud heights in compliance with Code.

B. Top and bottom runner, and bridging:

1. As recommended by the manufacturer of each stud type and of same-gage as stud in same wall or partition, unless otherwise indicated on the Drawings. Provide unpunched, screwable tracks, gage to match studs, 1-1/2-inch flanges.
2. For shaftwalls: Where studs extend to the underside of floor or roof slabs, secure at top with “Fire Trak Cavity Shadowline” track by Fire Trak Corp. or other Code-compliant assemblies acceptable to the Architect.
3. For other fire-rated partitions: “MaxTrk” or “Blazeframe” both by ClarkDietrich Building Systems, “Fire Trak” by Fire Trak Corp., "Sliptrack Systems, Inc. "Slip-Trk" for fire-rated partitions, Fire Trak Corp. “VertiTrack VTD VTX” by the Steel Network, Runners by Blaze Frame, or other Code-compliant assemblies acceptable to the Architect.
4. Elsewhere: Use either “Slip Track 250” by ClarkDietrich Building Systems, or equal track matching (as a minimum) the stud gage in same wall but with a 2-1/2 inch leg, or a deep leg 54 mils thick (16-gage) minimum slip connection to accommodate slab deflection.

C. Joist framing:

1. Steel Joists: Manufacturer standard C-shaped steel joists, of web depths indicated, punched or unpunched, with stiffened flanges, and as follows.

   a. Minimum base-metal thickness: 20-gage minimum.
   b. Flange width: 1-5/8-inch, minimum.

2. Steel joist track: Manufacturer standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

   a. Minimum base-metal thickness: 20-gage minimum.
   b. Flange width: 1-5/8-inch, minimum.

D. Furring channels:

1. For gypsum board and soffit board:

   a. Zee furring channels: 30 mils thick (20-gage) model ZFN3 by Dietrich Industries, Inc. of depth to match insulation thickness, or equal.]
   b. All others (except resilient channels): 18 mils thick (25-gage) minimum, galvanized, hat-shaped.

2. For lath/plaster: 3/4-inch size as specified hereafter for runner channels.

E. Prefabricated headers: At the Contractor’s option, ProX Header assemblies by Dietrich Industries or Cemco may be used in lieu of job-assembled headers.

F. Horizontal stiffener, runner channels and bridging: 54 mils thick (16-gage) channels fabricated of cold-rolled steel, ASTM A 366, with flanges not less than 7/16-inch wide. Minimum weights as follows:

Channel Size	Flange Width	Pounds/1000 linear foot
3/4-inch	7/16-inch	300
1-1/2-inch	7/16-inch	475
2-inch	19/32-inch	590

G. Resilient channels: RC-1 by USG, R/FC-1 by Dale Industries, Resilient Channels by Scafco, fabricated from steel sheet complying with ASTM A 924 or ASTM A 568.

H. Resilient sound clips: Super Soundproofing Co., “SSP Sound Isolation Clips” or Acoustical Surfaces, Inc. “Noise STOP clips RSIC-1.”

2.4 FASTENERS AND ACCESSORIES

A. For low (Pony) walls: Use “Floor Anchor” stud reinforcement by Pinquist Tool & Die Co., Inc. at every stud.
B. Screws:

1. ASTM C 1002 for metal framing 18 mils thick (25-gage) and lighter, ASTM C 954 for heavier metal framing, 3/8-inch head diameter, corrosion-resistant pan head screws; length and gage required by Code, or recommended by the metal framing manufacturer when not prescribed by Code.
2. For soffits and overhead surfaces, use with appropriate washers but not less than one-inch OD by 1/4-inch ID by 54 mils thick (16-gage) cut washer.
3. Screws for gypsum board mounted on resilient channels shall have a maximum length of one-inch for one layer and 1-5/8-inch for 2 layers.

C. Shot pins: 0.140-inch diameter low velocity powder-actuated drive pins equivalent to Ramset/Red Head No. 1508, or equal, with 7/8-inch minimum penetration into concrete.
D. Anchor bolts: ASTM A 307, non-headed type.
E. Expansion shields: FS FF-S-325, except do not use lead, fiber and plastic shields.
F. Furring channel clips: Manufacturer standard clips for attaching gypsum board furring channels to runner channels.
G. Welding electrodes: ASTM A 233, as recommended by AWS for the conditions of use and the metals to be welded.
H. Wire: ASTM A 641, galvanized, soft-annealed steel, minimum gage as follows.

1. Ceiling and soffit suspension system: 8 BW gage.
2. Furring channel to runner channel: 16 BW gage.
3. Ties and splices in channels: 18 BW gage.

I. Pocket door framing: By Pemko, or equal, complete with extruded aluminum track and aluminum-reinforced studs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

1. Ceiling anchorage:

a. Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
b. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

2. Before fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fireproofing. Where offset anchor plates are

required, provide continuous units fastened to building structure not more than 24 inches o.c.

3. After fireproofing has been applied, remove only as much fireproofing as needed to complete installation of metal framing assemblies without reducing thickness of fireproofing below that required to obtain fire-resistive rating indicated. Protect remaining fireproofing from damage.

3.3 INSTALLATION VERTICAL FRAMING

A. General:

1. Erect metal framing systems in compliance with their manufacturer's recommendations, the reference standards, the Drawings and these Specifications.
2. Use minimum 33 mils thick (20-gage) studs at the following locations:

    a. Door openings.
    b. Studs supporting cement backer boards.
    c. Studs supporting backing plates, plumbing fixtures and wall-supported cabinets.
    d. Elsewhere as indicated.

3. Do not attach metal framing and suspension wires to ducts, conduits or pipes. Do not allow metal framing and suspension wires to contact pipes.
4. Isolate framing from transfer of structural loading, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
5. Cut framing components squarely for a tight fit against abutting members. Erect framing plumb and level to provide solid backing for finish materials. Install all steel studs in a wall/partition so that their flanges point in the same direction.
6. Do not exceed a 1/8-inch in 10 feet deviation (non-cumulative) from true lines and levels, or 1/4-inch from true position. Perform necessary remedial work on framing to achieve specified tolerances.

B. Wall/partition framing:

1. Layout partitions, soffits and ceiling breaks, and permanently mark on slabs and soffits.
2. Align and securely anchor ceiling and floor tracks to building construction.
3. Space anchors within 6 inches of ends of each track segment and at 24 inches o.c. maximum. Do not drive fasteners closer than 2 inches to slab or curb edge.
4. Frame all openings in stud walls. Provide double studs, closer spacing, and additional reinforcement as detailed or required at door frames, borrowed light frames (interior windows), and recesses for equipment.
5. Frame both sides of control joints in gypsum board surfaces, and Portland cement plaster surfaces with separate studs and discontinuous runner; do not bridge the joint with system components or accessories.
6. Assemble corners using a minimum of 3 studs.
7. Install studs in single length, without joints, extending from floor to underside of floor or roof structure above, except where indicated on the Drawings to stop at or above suspended ceilings. Splicing studs is not permitted without the Architect's approval.
8. Where studs stop at or above suspended ceilings, unless otherwise indicated, brace every fourth stud (maximum) with opposite stud bracing at 45-degree angle securely anchored to the floor or roof above.
9. Offset studs where required so that finished wall surface will be flush.

10. Where curved walls are indicated, space studs at no more than 9 inches o.c.; space stud closer where radius requires it. Cut outside leg and entire web of runners at 2 inches intervals for the length of the arc then attach a 1-inch wide by 18 mils thick (25-gage) steel strip securely inside the cut leg of runners lapping uncut leg a minimum of 4 inches.

    a. As an option to the above, Contractor may use curved runners by Radius Track or Flex-C Trac by Flex-Ability Concepts.
    b. Position a stud at the beginning and end of each arc, with intermediate studs equally spaced between end studs of arc.

11. Attaching studs to runner:

    a. +Attach studs to tracks by friction fit for single stud gypsum board partitions.
    b. Attach the following studs to runner tracks with screws or with a crimping tool in compliance with the stud manufacturer's printed instructions, except where indicated to be welded.

        1) Studs with gypsum board on only one side.
        2) Studs in curved walls.
        3) Studs supporting lath/plaster assemblies.
        4) Studs supporting stone veneer**.**
        5) Studs on each side of doors and windows.
        6) Studs supporting wall hung plumbing fixtures.
        7) Studs supporting wall hung urinal screens, toilet compartments, cabinets and equipment.

    c. Attach corner studs, partition intersections, studs on each side of door jambs, and other openings in walls/partitions as specified in Paragraph "b" above.
    d. Weld studs where indicated on the Drawings.

12. Unless otherwise indicated, provide horizontal stiffeners consisting of 3/4-inch channels spaced at not more than 54 inches o.c. maximum in all partitions/walls supporting wall supported cabinets and lath/plaster assemblies, and stone. Tack-weld stiffeners to each stud.

    a. Provide an additional 3/4-inch channel 6 inches above door head and extend 2 stud spaces beyond jamb studs.
    b. Install channels in longest possible lengths; lap 12 inches and wire-tie at joints. Do not tie channels on opposite sides of staggered and double stud partitions together.

13. Double gypsum board studs (face to face to form a tube) adjacent to doors and openings. Extend studs at door openings to slab or deck above and anchor securely to bottom track (as specified in subparagraph 10.b. above) and to top slab or deck with clip angles.

    a. Locate additional studs not more than 2 inches from door and window frames, abutting partitions, partition corners, and other construction.
    b. Install a section of track over door and window frames with a clip angle at each end and attach securely to the adjacent vertical studs.
    c. Install cut-to-length studs at the location of vertical joints and at standard spacing over the door frame header extending to the ceiling track.

14. Install studs 2 inches away from abutting concrete, steel columns or other structural elements. Extend the horizontal stiffeners and attach it to the structural element.
15. Provide additional framing, as required, for attachment of electrical boxes, fire extinguisher cabinets and similar items located in stud walls.

C. Resilient furring channels:

1. Install, with mounting flange down, at right angle to studs, starting within 2 inches of floor and 6 inches from ceiling.
2. Splice channels directly over studs and attach through both flange to studs.
3. Space channels as indicated on the Drawings.
4. Drive screws through channel attachment flange and studs at each intersection.

D. Resilient sound clips: Install the resilient clips in accordance with their manufacturer's instructions, and the following at the spacing indicated.

1. Install clips level and aligned on each wall.
2. Space bottom clips (and supported channel) no more than 3 inches from floor.
3. Space top clips (and supported channel) no more than 6 inches from ceiling.
4. Install furring channels securely in each clip.

3.4 SUSPENDED FRAMING FOR LATH/PLASTER AND GYPSUM BOARD ASSEMBLIES

A. Space 1-1/2-inch main runners not over 4 feet o.c. in any dimension so that hanger wires do not support more than 12 square foot of ceiling. Attach hanger wires from in-place floors and roof as indicated on the Drawings. Do not use shot pins.
B. Hang suspended framing independent of walls, columns, pipes, ducts, and conduits, and their insulation.
C. Do not attach wires to, or bend around, interfering material such as ductwork, pipes and conduits. Provide trapeze, or equivalent devices substantiated by detailed Shop Drawings and calculations, where obstructions interfere with direct suspension.
D. Space runner channels not more than 6 inches from parallel walls or beams. Align runner channels accurately relative to indicated ceiling height and saddle-tie with hanger wires. Lap channels 12 inches at splices and tie at each end of lap.
E. Attach furring channels to runner channels with 16-gage tie wire or clips. Space at not over 12 inches o.c. for lath/plaster assemblies, and 16 inches o.c. for gypsum board. Locate approximately 2 inches from parallel walls. Lap channels 12 inches at splices and tie at each end of lap.
F. Assemble and install metal grillage so that it is rigid, square, and free of movement, and level within the tolerances specified.
G. Provide seismic bracing and compression struts as required by Code.

3.5 FURRING

A. Provide furring attached to concrete and metal framing to conceal utilities, furred soffits, and other furring as indicated.
B. Furring to receive gypsum board shall be screw-on channels directly attached to backing material, or applied over runner channels as applicable.
C. Furring to receive plaster shall be 3/4-inch cold-rolled channels wire tied to 1-1/2-inch runner channels.
D. Space furring as indicated for studs.

3.6 WELDING

A. Perform welding in compliance with AWS recommendations. Welders shall be qualified to weld lightgage metal. Provide stitch plates where studs are burned-through.

3.7 BACKING PLATES

A. Backing plates may be omitted if anchorage for wall-hung items is directly into steel studs of 43 mils thick (18-gage) or heavier, or items are furnished with equal mounting devices.

B. Wall-mounted and wall-hung items that require backing plates, without limitation, include the following:

1. Wall supported railings.
2. Grab bars.
3. Toilet compartments and screens.
4. Toilet room accessories.
5. Lockers
6. Wall and base cabinets.
7. Plumbing fixtures.
8. Ladders.
9. Elevator screens.
10. Wall mounted door stops.
11. Bracket-mounted fire extinguishers.
12. Signage.
13. Window shades.
14. Wall mounted furniture.
15. Wall mounted bench in the shower stall.
16. Visual display and tack boards.

C. Unless otherwise indicated, plates not provided with fixtures and equipment shall be long enough to span, as a minimum, across 3 studs and may be one of the following:

1. Fifty-four mils thick (16-gage) minimum steel plate by 4 inches wide.
2. Fifty-four mils thick (16-gage) unpunched wide flange stud by 4 inches wide.

D. Notch studs so that backing plate will be flush with exterior face of stud.
E. Weld plates continuously along all contact surfaces at each stud crossing, or secure with 2 countersunk machine screws at each stud.

END OF SECTION

SECTION 09 24 00 - LATH AND PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Lath and lathing accessories.
2. Portland cement plaster (ST-1, ST-2).

B. Related requirements:

1. Section 09 90 00 for field painting over integral color plaster.

1.2 SUBMITTALS

A. Data: Manufacturer Product Data for fiber reinforcement, additives, metal lath and metal trim members.

B. Shop Drawings: Dimensioned drawings showing the following.

1. Windows and other openings and penetrations in plaster walls.
2. Proposed locations and types of metal lathing accessories (screeds, control joints, etc.) in plaster surfaces.
3. Schedule of proposed control joints and metal trim items keyed to minimum 1/8-inch scale building elevations.

C. Affidavit: Signed by materials supplier stating that sand delivered to jobsite complies with the requirements of this Section.

1.3 QUALITY ASSURANCE

A. Mockups: Assist in building composite mockup for each glass product indicated below in accordance with the following requirements, using materials indicated for the completed Work.

1. See Section 01 48 38 for composite mockup.
2. Build mockup in the location and of the size indicated or, if not indicated, as directed by Architect; finish as specified.
3. The Architect will inspect the mockup for color and texture. Make all corrections required, including the construction of additional mockups if the first one is disapproved, until Architect's approval is secured.
4. Promptly remove rejected mockup(s) from the jobsite and dispose of it (them) off the site.
5. The remainder of the cement plaster installed on the job shall match the approved mockup finish.

1.4 HANDLING

A. Delivery: Deliver materials, except sand and water, to the site in sealed containers or bags clearly identified with manufacturer's name, brand, type and grade.

B. Storage: Store lathing materials on platforms under plastic sheeting. Store plastering materials, including sand, on platforms under plastic sheeting to prevent hydration or contamination.

1.5 JOB CONDITIONS

A. Protect adjacent surfaces from damage as a result of plastering operations.

B. Protect plaster against extreme climatic conditions, including uneven and excessive evaporation from hot dry air.

PART 2 - PRODUCTS

2.1 LATHING MATERIALS

A. Paper weather barrier: 2 layers complying with UBC 94 Standard y14-1 and FS UU-B-790, Type I, Grade D (vapor permeable), Style 2, except with a water resistance of 60 minutes; Fortifiber Corp. "Super Jumbo Tex" or equal.
B. Lath:

1. Expanded diamond mesh lath weighing 3.4 lbs./square yard. made from zinc-coated (galvanized) steel sheet to produce lath complying with ASTM C 847, by Western Metal Lath, Amico West, Cemco,, or equal.
2. On solid surfaces use self-furred lath.

a. Self-furring, 3.4-lb. diamond welded wire lath complete with accessories: Mega Lath by Structa, or equal.

C. Tie-wire: Galvanized, annealed steel wire 16-gage for lath-to-supports and 18 gage for accessories-to-lath.
D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.

2.2 PLASTERING MATERIALS

A. Pre-mixed, fiber-reinforced brown and scratch coats: “Fiber 47 Fastwall Scratch and Brown” by La Habra/Parex, “BMI 690 Plaster, Standard with Fibers” by Sika/BMI Products, or equal.
B. Pre-mixed finish coat:

1. Enrock “Image Smooth” custom colors selected by the Architect.
2. 534 Sand Fine standard acrylic finish (16/20), custom colors selected by the Architect at specific locations shown on drawings.

C. Fiber glass reinforcing mesh: Heavy-duty glass fiber mesh with a coating compatible with Portland cement plaster, “CrackShield” by LaHabra, or equal by Omega Products International, Cota Industries, Inc., or Dryvit. Provide 48 inches wide rolls.
D. Acrylic admixture: “Acrylic Bonder” by La Habra, or equal by Synergy, C-Cure or Standard Drywall Products, Inc. Use same manufacturer's products for all plaster coats.
E. Reinforcing mesh adhesive: “Stucco Level Coat” by Parex, or equal compatible adhesive with brown and finish coats, as recommended by the mesh manufacturer.
F. Pipe and electrical boxes flashing: Quickflash assemblies by Quickflash Products – no known equal.
G. Sealant: Silicone sealant as specified in Section 07 92 00.
H. Water: Potable and fresh, from domestic source.

2.3 PLASTER MIXES

A. General:

1. Mix each batch for the same amount of time.
2. Mix batches the same size, using the same amount of water, to ensure consistency.
3. Briefly re-mix before using (approximately 2 minutes).
4. Use immediately after mixing. Do not retemper.
5. Add admixture after dry components and the majority of the water have been mixed. Mix no longer than required to provide a uniform mixture. DO NOT OVER-MIX.
6. Do not re-temper mixes over 20 minutes old.

B. Plaster proportions:

1. Base coats: Mix bagged sand/fibers with acrylic admixture (one quart for an 80 lbs bag of premixed scratch and brown coats, unless other proportions are recommended by the manufacturer.
2. Finish coat: Specified premixed finish coat.

C. Mixing: Mix as accurately as possible. Add ingredients to the mixer from calibrated containers. Do not use materials that are caked, lumpy, dirty or contaminated by foreign materials.

2.4 ACCESSORIES

A. General: Galvanized steel, unless otherwise specified.
B. Aluminum reveals molding: Fry-Reglet, sizes and location as shown on the drawings. Aluminum shall be extruded alloy 6063 T5. See RV-1, RV-2 and RV-4 on Drawings for shapes.

1. Shop prime reveals to receive final paint under Section 09 90 00.

C. Reinforcement:

1. Interior Corners: #30 corner Master Control Joint by ClarkDietrich or equal.
2. Exterior Corners: #1A Expanded Corner Bead by ClarkDietrich or equal.

D. Screeds and Molds: Per Plaster and Drywall Systems Manual, size and profile as indicated on the Drawings and as necessary to suit application.
1. 22-gauge galvanized steel. Hem exposed edges. Furnish in longest possible lengths.
2. Furnish drip screeds with weep holes every 2-inches.

E. Trim:

1. Hot-dip galvanized steel trim: Basis of design is for minimum 26-gage, supplied in longest obtainable sing lengths to minimize joints, by Brand X or CEMCO as indicated, or equal by Amico, CEMCO, Keene/Metalex Corp., Superior, Stockton Products or Unimast Inc.
2. At locations where new trim will contact or continuation of existing trim, shapes shall be identical.

   a. Plaster stops at window jambs: DFS-175 by Brand X.
   b. Plaster stops at window trims with surrounds: DFS-1375 by Brand X.
   c. Plaster stops with drip edges: DFWD-15375 by Brand X.
   d. Control joint expanded wing control joint: “No. XJ15” by CEMCO.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Before plastering begins, insure that adjacent finish work is well protected with waterproof covers securely taped in place and Air & Water Barrier is installed to provide a watertight installation.
C. Before enclosing stud walls, thoroughly clean space of debris.
D. Correct other detrimental conditions before proceeding with installation.

3.2 GENERAL

A. The applicable provisions of ASTM C 1063 and ASTM C 926, govern the work of this Section, except as specified herein.

3.3 PAPER WEATHER BARRIER

A. Install over the gypsum sheathing and framing members with a minimum of fasteners.
B. Lap shingle fashion 2 inches at horizontal joints and 6 inches at vertical joints. No weather barrier is required on soffits. Stagger vertical joints.
C. Continue weather barrier uninterrupted behind control joints.
D. Lap over flange of accessories to prevent direct contact between lath and accessories and to ensure water tightness.
E. Interface weather barrier with flashing materials at windows, doors, and elsewhere, to properly discharge water to the exterior face of the wall. Absence of flashing must be corrected prior to installing weather barrier.
F. Interface weather barrier with flashing materials to properly discharge water to the exterior. Correct absence of flashing prior to installing weather barrier.
G. Seal unused holes from fasteners in weather barrier with silicone sealant specified in Section 07 92 13.

3.4 LATHING

A. Comply with ASTM C 1063, except as specified below, and where Code requirements are more stringent.
B. Apply lath taut, with long dimension at right angle to supports. Work from right to left, extend both horizontal and vertical factory flaps. Make sure that paper weather barrier encloses all surfaces to be plastered.
C. Apply first course at bottom and work up. Make overlaps shingle fashion to assure waterproof joints; lap paper-to-paper and lath-to-lath. Stagger vertical joints. Lap joints one-inch minimum and horizontal joints 1/2-inch minimum. Wire-tie intermediate horizontal joints at 9 inches o.c. maximum.
D. Install metal lath panels so that each vertical joint is approximately centered in the panel beneath it. Wire-tie intermediate horizontal joints at 6 inches o.c. maximum.
E. Cut lath at control joints.
F. Attach lath to supports at 6 inches o.c.
G. At control joints, cut lath but continue paper backing uninterrupted behind lath.
H. Hold lath 1/4-inch clear of electrical boxes, columns and similar items projecting through the plaster.

3.5 METAL TRIM

A. Wire-tie at no more than 24 inches o.c. to metal lath or studs. Fastening accessories with screws is not acceptable.
B. Use trim in single length wherever length of run does not exceed longest standard stock length available. Miter or cope at corners with hairline joints, and seal with sealant specified in Section 07 92 13.
C. Set accessories level, plumb and true to line with a tolerance of not more than 1/8-inch in 5 feet. Shim as required and align joints with concealed splice or tie plates.

    1. Where joints meet, make sure that design is uninterrupted, and that joints between accessories are flush, in-line and hairline tight. Where joints occur between parallel stud or channel supports, install an additional support for the individual flanges.
    2. Accessories that butt each other need to be lapped, sealed, soldered or welded, and/or stripped with flexible flashing.

D. Install corner reinforcement at external corners.
E. Provide casing beads at the following locations:

1. Where plaster termination abuts other finishes, isolate casing bead from contact with adjacent finishes with 1/4-inch thick tape sealant specified in Section 07 92 00.
2. Where plaster termination is not covered by another finish or applied trim, provide cased opening by installing casing bead around perimeter of opening as detailed.

F. Control joints:

1. Install vertical control joint first, continuous from top to bottom of wall; install horizontal control joints second and split where it meets the vertical control joint.
2. Install joints plumb, level, evenly spaced where so indicated, and in one piece at the spacing indicated.
3. Follow manufacturer's directions for their installation.
4. Maximum area of plaster without control joints shall not exceed 144 sq. ft. within a ratio of 2 to 1.5 (width vs. height). Horizontal or vertical expansion joints shall be located and coordinated with Structural.

3.6 PLASTERING

A. General: Comply with ASTM 926, except as specified below, and where Code requirements are more stringent.
B. Type: Smooth-finished Portland cement plaster installed on metal lath; one-inch total thickness.
C. Allowable tolerances: Maximum deviation from true planes of finish plaster shall not exceed 1/8-inch in 10 feet when measured with a straightedge placed at any point on the plaster.
D. Protection:

1. Protect adjacent surfaces from damage as a result of plastering operations.
2. Protect plaster against extreme climatic conditions, including uneven and excessive evaporation from hot dry air.

E. Application - general:

1. Provide sufficient manpower and equipment to ensure a continuous operation free of cold joints, scaffold lines, texture variations, and other objectionable conditions.
2. Plaster surfaces in one operation once the application of any coat begins.
3. Stop plaster at control joints, edges or corners only. Plaster in one operation, full height and width between control joints.
4. Plaster flush with metal trim members and make corners square and true.
5. Where permanent grounds are too far apart to serve as guides for rodding, provide supplemental plaster screeds as required. Establish true surfaces with rods before setting the screeds. Keep grounds clean and free of plaster.
6. Finish plaster in a true, plumb or level plane flush with grounds.

F. Plastering:

1. Scratch coat: Apply with sufficient material and pressure to form good full keys, and to cover well.

a. Thickness of scratch coat shall be 1/2-inch when measured from backing to crest of scored plaster.
b. Scratch before plaster hardens to provide sufficient mechanical key for brown coat.
c. Cure acrylic-modified plaster in accordance with its manufacturer's instructions, including holidays and weekends. Do not over-wet by excessive curing, unless hot conditions exist.

2. Brown coat:

    a. Dampen the scratch coat thoroughly and apply the brown coat to a 3/8-inch thickness.
    b. Bring to a true, even surface by rodding and floating, and leave slightly rough to receive the reinforcing mesh.
    c. Begin floating only after hydration of the cement has commenced and sufficient moisture has evaporated, so that surface sheen has disappeared, but before plaster has become too rigid to be moved under the float.
    d. Cure acrylic-modified plaster in accordance with its manufacturer's instructions, including holidays and weekends. Do not over-wet by excessive curing, unless hot conditions exist.

3. Reinforcing mesh adhesive:

    a. After the brown coat is properly cured, apply a layer of reinforcing mesh over the brown coat in a 1/8-inch thick bed of cement adhesive.
    b. Cement adhesive may be a proprietary adhesive as specified, or a job-mixed preparation consisting of 48 lb. of common Portland cement, 10 lb. of plaster grit silica sand, and emulsified acrylic admixture mixed with water.

4. Reinforcing mesh: The mesh is required over the brown coat and shall be completely embedded as follows by 3 different methods as selected by the Contractor and successfully demonstrated on the approved mockup. In all cases, completely embed the mesh into the base coat free of wrinkles and fish mouths, and trowel smooth, ensuring that no mesh is visible. A minimum 2-inch overlap is required at mesh joints.

    a. Method One: After application of brown coat and before final set occurs, fully embed mesh into the brown coat.
    b. Method Two: After brown coat has properly cured, apply the base coat over the brown coat a minimum of 1/6-inch thick and completely embed mesh.
    c. Method Three: The finish surface must be clean and free of loose debris, dirt, dust, efflorescence, grease, oil, curing agents and cleaning solutions. Painted or glossy surfaces may need to be roughened to ensure proper bond of the base coat. The substrate must be structurally sound. Apply the base coat over the existing finish a minimum of 1/6-inch thick and completely embed mesh.
    d. After embedding mesh, the surface shall be left suitable for the application of the finish.

5. Finish coat: Apply finish coat when temperatures are between 65 and 90 degrees F.

    a. Apply the finish coat in a double back operation to a total minimum thickness of 3/16-inch.
    b. Trowel on a tight first finish coat a minimum of 1/16-inch thick and draw it up to an even surface before applying the double back coat.
    c. When the finish coat sets, trowel it to smooth and even surface free of tool marks, blemishes or cracks, matching the approved mockup in all respects, as approved by the Architect.

G. Plaster flush with metal frames and other built-in metal items or accessories which act as plaster grounds. Provide a "V" cut with the edge of the trowel where plaster abuts metal frames.

H. Where permanent grounds are too far apart to serve as guides for rodding, provide supplemental plaster screeds as required.

1. Establish true surfaces with rods before setting the screeds.
2. Keep grounds clean and free of plaster.
3. Finish plaster in a true, plumb or level plane flush with grounds.

I. Entire plaster must be flush with top of accessories; wavy finish (higher at accessories than in the field) is not acceptable.

3.7 FIELD QUALITY CONTROL

A. The curing periods recommended by the manufacturer shall be considered as minimum requirements. Be responsible for determining the most effective procedure for curing and time lapse between application of coats, based on climatic and job conditions.
B. Completed plaster shall match approved mockup, be within the tolerances specified, be uniform in thickness, texture and color when applicable, free of cracks, blisters, pits, checks and other defects.
C. Repair, or remove and replace, as determined by the Architect, lath/plaster that does not meet these requirements, with materials satisfactory to the Architect.

3.8 FINISH

A. Finishes for the cement plaster: Sand Float finish throughout the project.

3.9 REPAIRING/CLEANING/PROTECTING

A. Cut, patch, repair and point-up defective plaster. Repair cracks and indented surfaces by moistening plaster and filling with new material, troweled or tamped flush with adjoining surfaces. Point-up finish plaster surfaces around items built into or penetrating the plaster.
B. Promptly remove plaster spatter and droppings from adjacent surfaces. Repair surfaces which have been stained, marred or otherwise damaged during plastering operations at no additional cost to the Owner.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Gypsum board.
2. Fasteners, joint reinforcing and finishing compound.
3. Skim coating of concrete soffits and ceilings.

B. Related requirements:

1. Divisions 05 and 09 for metal framing supporting gypsum board (except for framing specified herein).
2. Division 06 for gypsum sheathing board.
3. Division 08 for access panels in gypsum board surfaces.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Pre-installation meeting:

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for all materials to be used in gypsum board construction.
B. Shop Drawings: Show proposed locations of control joints. Joint locations is subject to the Architect’s approval and shall be relocated, when requested, at no cost to the Owner.
C. Samples: Three 24-inch square Samples with the medium orange peel spatter coat specified for architect’s approval. Approved sample will become Architect’s control sample.

1.4 QUALITY ASSURANCE

A. Requirements of regulatory agencies:

1. Comply with fire resistance ratings indicated and required by Code.
2. Provide materials, accessories and application procedures listed by UL or tested in compliance with ASTM E 119 for the type of construction shown.

B. Mockup:

1. Where directed, construct a mockup of a gypsum board wall and ceiling inside the building. Make mockup full height (minimum 8 feet high by 8 feet wide) with a 4-foot return.
2. Tape and finish joints, trim and screw heads as specified for Level 5 herein. Refer to Section 09 90 00 for painting of the mockup with a semi-gloss paint.
3. The Architect will review the mockup under various light conditions for defects and improperly finished joints, trim and screw heads. Provide a portable light for that purpose when so requested.
4. Make corrections requested by the Architect or remove and replace mockup when the corrective work is not acceptable to the Architect.
5. The approved mockup shall remain in the building until its removal is directed, and will be used as a standard for the gypsum board work for the Project.

1.5 HANDLING

A. Procedure: In accordance with GA 801 "Handling and Storage of Gypsum Panel Products."
B. Storage: Do not overload the floors with localized concentration of gypsum board.

1.6 JOB CONDITIONS

A. Comply with the gypsum board manufacturer's recommendations and GA “Application and Finishing of Gypsum Board” for temperature limitations and ventilation before, during and after installation of gypsum board.
B. Protect installed materials from drafts during hot, dry weather.
C. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. American Gypsum.
B. CertainTeed Gypsum.
C. Continental Building Products LLC.
D. G-P Gypsum Products.
E. National Gypsum Co./Goldbond Building Products Division.
F. PABCO Gypsum.
G. US Gypsum Co.

2.2 INTERIOR GYPSUM BOARD

A. General:

1. Provide boards complying with ASTM C 1396 as follows and in maximum lengths available to minimize end butt joints.
2. Unless otherwise acceptable to the Architect, no end-to-end butt joints are allowed on walls or ceilings less than 12feet long or wide.

B. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8-inch.
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

E. Within 8 feet of floor, except in closets: Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.

3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact Resistance: ASTM C1629, meets or exceeds Level 3.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

F. In unlined air shafts and plenums: USG Sheetrock “Mold Tough,” National Gypsum “XP Mold & Moisture Resistant Gypsum Board, or equal meeting ASTM D 3273 for mold-resistance.

G. On ceilings: Contractor may use “Gypsum Ceiling Boards.”

1. ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

H. For surfaces to be painted in toilet rooms: CertainTeed “Glasroc,” National Gypsum eXP Tile Backer, or equal embedded glass mat gypsum panels.

I. Elsewhere where gypsum board is exposed and painted: Standard, Type X or C boards, as applicable to the assembly. Provide boards with paper face suitable to receive decorative finish, and long edges tapered to receive joint compound.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 ACCESSORIES

A. Screws: The following sized in compliance with the gypsum board manufacturer's instructions and Code requirements.

1. ASTM C 954 for fastening to supporting studs and furring.
2. ASTM C 1002, Type G for gypsum board-to-gypsum board.

B. Metal trim: Except where extruded aluminum reveals are indicated, provide Galvanized steel of the types specified hereafter complying with ASTM C 1047.

1. Extruded aluminum trim: Profiles and dimensions indicated, by Fry Reglet Corp., Stockton Products, or Gordon, Inc.
2. LC-Bead: J-shaped; exposed long flange to receive joint compound; use at exposed panel edges.
3. CB corner bead: Square corner bead.
4. L-Bead: L-shaped; exposed long leg to receive joint compound; use where indicated.
5. U-Bead: J-shaped; exposed short flange not to receive joint compound; use at exposed panel edges.
6. Curved-edge cornerbead: With notched or flexible flanges; use at curved openings.
7. Control joint: USG No. 093, Goldbond Building Products E-Z Strip or Trim-Tex 093V.

C. Resilient channels: RC-1/FC-1 by Dale Industries, or equal, fabricated from steel sheet complying with ASTM A 924 or ASTM A 568.
D. Zee furring members: Manufacturer's standard Z-shaped furring members with slotted or non-slotted web, fabricated from steel sheet complying with ASTM A 924 or ASTM A 568; with a minimum base metal (uncoated) thickness of 0.0179-inch, face flange of 1-1/4-inch, wall-attachment flange of 7/8-inch, and of depth required to fit insulation thickness indicated.
E. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate
F. Column and beam clips: “Claw” by Claw International, or equal.
G. Joint treatment for paperless assemblies: 2-inch wide fiberglass mesh tape and ToughRock 90 Setting Type joint compound, or equal.
H. Joint tape, compound and laminating adhesive: ASTM C 475, low or very low shrinkage, type recommended by the manufacturer, by Hamilton Materials, basis of design, USG or one of the gypsum board manufacturers named above.

1. Taping, and fastener and metal trim concealment: Sheetrock Brand Taping Joint Compound, Ready-Mixed by USG.
2. Topping, finish and skim coats: Sheetrock Brand Topping Joint Compound, Ready-Mixed by USG.
3. Joint tape complying with ASTM C475: Sheetrock Joint Tape – Heavy by USG.

I. Acoustic sealants: As specified in Section 09 80 00.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine conditions affecting the work of this Section at site.
B. Verify framing members’ straightness and alignment.
C. Correct detrimental conditions before proceeding with installation.
D. Before enclosing stud walls and spaces that will be inaccessible after gypsum board is installed, thoroughly clean spaces of debris and dust.

3.2 RESILIENT FURRING CHANNELS

A. General:

1. Splice channels directly over studs and attach through flange to studs.
2. Space channels as indicated on the Drawings.
3. Drive screws through channel attachment flange and studs at each intersection.

B. Walls: Install channels, with mounting flange down, at right angle to studs, starting within 2 inches of floor and 6 inches from ceiling.
C. Ceilings:

1. Install channels perpendicular to the joists and space at 16 inches o.c. maximum, unless otherwise indicated.
2. Start perimeter channels no more than 2 inches from the intersection of ceiling-to-wall.

3.3 GYPSUM BOARD INSTALLATION - GENERAL

A. Comply with the applicable provisions of the reference standards and the following.
B. Use only full-size boards above door and window openings; joints at corners of heads are not acceptable.

C. Minimize butt joints and avoid butt joints centered on walls, over protruding studs, and above doors and windows. Avoid abutting end joints in the central area of each ceiling.
D. Install all panels, including those in non-rated applications, with joints in moderate contact.
E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints.
F. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends.

1. Do not place tapered against cut edges or ends.
2. Where square (non-tapered) joints abut on ceilings, use Trim-Tex “Buttboard” behind the joint in accordance with Trim-Tex recommendations.

G. Stagger vertical joints over different studs on opposite sides of partitions.
H. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
I. Attach gypsum panels to framing provided at openings and cutouts.
J. Provide perimeter relief where board abuts structural decks, ceilings, vertical structural elements, or glazed assembly.
K. Install horizontal boards first. Butt joints between boards loosely. Do not force boards into place. Place tapered or wrapped edges next to one another.
L. Attach boards to all studs and furring members with power-driven screws securely engaging supporting member, and with fastener heads uniformly depressed not over 1/32-inch below surface of board (except for first layer of multiple layer assembly) without breaking face paper.
M. After boards have been installed over screws and backing plates, tap boards with a rubber mallet to depress backside of board over heads to eliminate unacceptable bulges.

3.4 SINGLE LAYER APPLICATION

A. Horizontal surfaces:

1. Install board with long dimension at right angle to supports, with end joints located over supports.
2. Use maximum practical length boards to minimize end joints. Stagger end joints in alternate boards.

B. Vertical surfaces: Unless otherwise acceptable to the Architect, install board vertically. Use floor-to-ceiling length boards (unless height exceeds 12-foot) with vertical joints located over supports.

1. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
2. Offset joints at least one stud on opposite sides of partition/walls.
3. Extend gypsum board continuously from finish floor to underside of structure above, except where indicated otherwise on the Drawings.

3.5 MULTIPLE LAYER APPLICATION

A. On vertical surfaces:

1. Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners at perimeters of boards.

3.6 ALLOWABLE TOLERANCES

A. Do not exceed 3/16-inch in 8 feet, and 1/8-inch in 4 feet from plumb, level and flat (all directions) in gypsum board surfaces.
B. Do not exceed 1/8-inch from geometry indicated for vaults and other curved surfaces.
C. Do not exceed 1/16-inch offset at joints between boards.
D. Shim boards as necessary to comply with these tolerances.

3.7 SEALANTS

A. The following is required at perimeter and penetrations of all gypsum boards in pressurized stair shafts and air plenums. These areas must be air-tight at the design pressures indicated.

1. Clean space to be calked of debris, dust and powdered materials which would prevent the sealant from adhering properly.
2. Seal openings between gypsum board and the perimeter of items penetrating gypsum board, such as electrical boxes, continuously using sealant specified.
3. Seal openings between the gypsum board, and floors and ceilings along gypsum board assemblies continuously, and along those intersecting assemblies for a minimum distance of 3-foot on each side. When multiple layers occur, seal the perimeter of each layer continuously.

3.8 FINISHING

A. Finish gypsum board surfaces with exposed joints, corners and edges reinforced or trimmed in compliance with GA-216, the following and to match approved mockup where applicable.
B. General:

1. Fill joints, fastener heads, trim accessory flanges and surface defects with joint compound in compliance with the gypsum board manufacturer's recommendations to obtain a smooth, flush surface.
2. All joints, fastener heads and trim flanges in surfaces which will remain exposed to view in the building, shall be invisible after application of joint tape and compound.
3. Fill and finish gypsum board-clad columns with a straightedge from corner bead to corner bead to eliminate concave surfaces between beads.

C. Trim: Install in single unjointed length, unless length exceeds manufacturer's standard. Attach to gypsum board in compliance with their manufacturer's instructions.

1. Install Type CB trim at external corners.
2. Install Type LC trim where gypsum board edges are exposed in the finish work.
3. Install Type CB or LC trim where gypsum board abuts a different material, and the edges are not covered by a finish material.
4. Install control joints at no more than 30 feet o.c. in any direction (full height door frames count as control joints). Joint locations are subject to the Architect's approval. When "through wall" control joints are required in fire-rated assemblies, comply with WH International, Inc. Report WHI 651-0318.1.

D. Joints: Reinforce joints between gypsum boards, and interior corners and angles with tape set in joint compound.

1. Apply skim coat over tape in one application.
2. Where space greater than 1/16-inch occurs between abutting gypsum boards (except at control joints and for concealed layers of multiple layer assemblies), pre-fill joints with joint compound and allow to dry before applying joint tape.

3. All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles.

E. Joint compound:

1. Lap each coat not less than 4 inches over the preceding coat (2 inches on each edge). Width of joint compound on tapered board edges shall be not less than 12 inches; width of joint compound on square board edges not less than 18-inch.
2. Cover fastener heads and accessories with 3 separate coats of joint compound.
3. Allow at least 24 hours drying time between applications of joint compound.
4. Finish joint compound so that little or no sanding is required. When sanding, use sandpaper or mesh cloth with grit as fine as possible; do not scuff face paper. Remove sanding dust before painting or applying other finishes.

F. Finishing levels:

1. Level 0: Use for first layer of multiple layer construction and gypsum board ledge guards in elevator shaft.
2. Level 1: Use in plenum areas above ceilings, interior faces of shafts, in attics, and in areas where the assembly will generally be concealed.
3. Level 2: Use where gypsum tile backer board is used as a substrate for tile, in storage and similar areas where surface appearance is not of primary concern.
4. Level 3: Use in areas to receive heavy or medium texture (spray or hand-applied) finishes before final painting, or where heavy grade wall coverings are to be applied as the final decoration.
5. Level 4: Use for all other areas to be painted and where light texture or backed lightweight wall covering will be applied.
6. Light orange peel wall and ceiling coat: Spray-apply in long, even strokes as uniformly as possible avoiding lap marks, and to achieve spatter sizes and density to match approved mockup.
7. Level 5 – skim coat (spray and roller-applied finish is not acceptable):

    a. Use for all other areas to be painted. Finish, including joints and fasteners as follows to match approved mockup.
    b. Apply a thin skim coat of joint compound to the entire surface to result in a smooth surface free of tool marks and ridges. Use setting-type, sandable topping compound or drying-type; do not use all-purpose compound consisting of high-build interior coating product designed for application by airless sprayer.

G. Skim coat on concrete surfaces: Apply over clean, dry concrete surfaces to a smooth, uniform finish free of trowel marks and other defects. Match approved mockup.
H. Leave gypsum board surfaces smooth, undamaged and ready to receive scheduled finishes.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior porcelain floor, wall tile and base (TL and TLB).
2. Waterproofing membrane.
3. Setting materials, grouts and sealants.
4. Floor sealer.

B. Related requirements:

1. Divisions 07 and 09 for sealants other than specified herein.
2. Division 09 for lath and scratch coat on walls.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting:

1. Prior to start of installation arrange a pre-installation meeting between the waterproofing manufacturer authorized representative, the Contractor, and the tile installer to review Project conditions, the Drawings, Specifications and the waterproofing manufacturer data. The Architect may attend.
2. If more than one trade will be responsible for the successful performance of the work of this Section, these trades shall attend the meeting.
3. Identify areas of concern and remedial measures.
4. Record meeting minutes and distribute copy to all concerned, including the Architect, within 48 hours after the meeting.

B. Manufacturer’s inspections:

1. Request the manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.
2. Unsatisfactory conditions disclosed by the manufacturer visits to the site shall be promptly and satisfactorily repaired and the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for waterproofing membrane, pre-mixed mortars and grouts, with certification that they meet ANSI standards specified.

B. Shop Drawings:

1. Show locations of each type of tile and tile pattern; widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
2. If joints occur in substrate to be tiled, show their locations on the Shop Drawings.

C. Samples:

1. Twenty-four-inch square Samples of each type and color of tile glued to hardboard backing; grout joints, if less than 24-inch tiles.
2. Each type, color and shape of trim and base.
3. Six-inch long transition threshold between stone and sports flooring, finished as specified.

D. Test Results: Submit test results in accordance with the test methods specified performed by a certified testing laboratory for each material specified.

1.4 QUALITY ASSURANCE

A. Uniformity:

1. Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
2. Obtain materials of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

B. Installer qualifications: Experienced firm who has successfully completed tile installations similar in material, design, and extent to that indicated for Project for at least 5 years.

C. Mockups: Before starting tile installation, erect one mockup for each form of construction and finish required. Build mockups complying with the following, using materials indicated for final Work.

1. Make each mockup a minimum of 6-foot square. Locate on site where directed by the Architect.
2. Mockups many remain part of the building where approved by the Architect.

D. Master grade certificate: Submit, bearing the Certification Mark of the Tile Council of North America, Inc. (TCNA), signed by the tile manufacturer, stating the type and quality of each type of tile delivered to the job site.

1.5 HANDLING

A. Procedure: In accordance with ANSI A137.1 for labeling sealed tile packages.

B. Delivery: Deliver tile cartons with grade seals unbroken.

1.6 JOB CONDITIONS

A. Set and grout this work when ambient temperature is at least 50-degree F or higher. Do not install materials on surfaces (or when ambient temperature) is less than 40-degree F.

B. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform this work and as will occur in the room or space after the building is in operation.

1.7 MANUFACTURER SPECIAL WARRANTY

A. Warrant tile installation, including grout and waterproofing (system warranty), against faulty materials and workmanship for 15 years after Substantial Completion.

B. Make repairs required during the warranty period at no cost to the Owner.

1.8 MAINTENANCE

A. Furnish one full box of each type, color and size of tile properly packaged and identified, by room or area.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI B101.3:

1. Level Surfaces: Minimum 0.42 (Wet).
2. Step Treads: Minimum 0.42 (Wet).
3. Ramp Surfaces: Minimum 0.60 (Wet).

B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI B101.1:

1. Level Surfaces: Minimum 0.60 (Wet).
2. Step Treads: Minimum 0.60 (Wet).
3. Ramp Surfaces: Minimum 0.80 (Wet).

2.2 MANUFACTURER

A. Dal-tile, basis of design. See TL and TLB in sheet A610 -Interior Finish Materials sheet.
B. American Olean.
C. Trinity.
D. Or equal.

2.3 MATERIALS – GENERAL

A. All components of the waterproofing and tile setting assemblies must be made or distributed by the same manufacturer to obtain warranty specified.

2.4 TILE

A. Tile: General:

1. Floor tile: Shall meet the static flooring demonstrating a dynamic coefficient of friction prescribed by ADAAG –of at least 0.42 or greater per 2012 ANSI A137.1 will be accepted as meeting the intent of slip resistance; CBC 11B-302 and ADA Standards 4.5.1.
2. Trim: Provide matching base, caps, stops, returns, trimmers required to complete the installation.

B. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements.

C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

D. Factory-blending: For tile exhibiting color variations within the ranges selected during sample submittals, factory-blend tiles and package accordingly so that tiles taken from one package show the same color range as those taken from other packages, and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation [in swimming pools] [on exteriors] [or] [in wet areas], do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.5 SETTING MATERIALS AND GROUT

A. Portland cement: ASTM C 150, Type 1.

B. Sand: ASTM C 144.

C. Water: Potable, fresh.

D. Setting bed reinforcing mesh: 2-inch by 2-inch by 16/16, 3-inch by 3-inch by 13/13 or 1-1/2-inch by 2-inch by 16/13 wire complying with ASTM A 82 or A 185.

E. Thin set, latex modified dry-set mortar: The following or equal with physical properties equaling or exceeding those of the products specified. Do not apply more than 1/4 inch thick and do not use for tiles larger than 15 inches complying with ANSI A118.15, A118.4, A118.11 and ISO 13007 C2EP1.

1. Custom (basis of design): FlexBond.
2. Mapei: Ultra Flex III.
3. Laticrete: 254 Platinum.
4. Or equal.

F. Medium bed: latex modified dry-set mortar: The following or equal with physical properties equaling or exceeding those of the products specified. For setting bed from 1/4- to 3/4-inch thick and for tiles larger than 15 inches in any dimension complying with ANSI A118.15, A118.4, A118.11 and ISO 13007 C2EP1.

1. Custom (basis of design): ProLite Tile & Stone Mortar.
2. Mapei: Ultraflex LFT.
3. Laticrete: 220 Marble & Granite w/3701 Mortar Ad-Mix.
4. Or equal.

G. Portland cement grout: One of the following, or equal with physical properties equaling or exceeding those of the products specified, sanded or unsanded as applicable to the joint width and recommended by the grout manufacturer.

1. Custom (basis of design): Sure Color Grout.
2. Mapei: Ultracolor Plus.
3. Laticrete: Perma Color.
4. Or equal.

2.6 MISCELLANEOUS MATERIALS

A. Tile levelers: Tuscan Seamclip by Pearl Abrasive Co. – no known equal.

B. Uncoupling mat: Strata-Mat by Laticrete, or Ditra XL by Schluter.

C. Transition strip between stone flooring and sports flooring: Schiene by Schluter or equal.

1. Material: Brushed stainless-steel.

D. Sealant and backup for control joints in tiles: Refer to Section 07 92 00.

E. Cleavage membrane: 10-mil thick polyethylene complying with ASTM D 2103, Type 13300.
F. Waterproof membrane: One of the following complying with ANSI A118.10.

1. “Hydro-Guard SP-1” by MerKrete.
2. “Hydro Ban” by Laticrete.
3. “Redgard” by Custom Building Products.
4. “Pro-Red” by C-Cure.
5. Or equal.

G. Reinforcing fabric: Custom (basis of design): Antifracture Membrane Mesh.
H. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Remove glaze and contaminants, including remaining adhesive and setting bed, from floors by scraping, wire-brushing or with a self-contained bead blasting apparatus.
C. Verify that surfaces to be tiled are firm, dry, clean, and free from oil or waxy films and curing compounds, and within the following tolerances:

1. Thin-set tiles:

a. 1/8-inch in 10 feet for floors and 1/8-inch in 8 feet for walls for tiles longer than 15 inches.
b. 1/4 inch in 10 feet for tiles with the maximum dimension less than 15 inches..

2. Mortar-set tiles: 1/4-inch in 10 feet for floors and 1/4-inch in 8 feet for walls.
3. Maximum deflection of walls to be tiled: L/360 under loads prescribed by Code. Coordinate this requirement with other design criteria specified in Section 09 22 16.
4. Maximum deflection of floors to be tiled: L/360 when measured under a 300 lb. concentrated load (ASTM C 627).

D. Examine that installation of grounds, anchors, recessed frames, electrical and mechanical work, and similar items located in or behind tile have been completed before installing tile.
E. At the Contractor’s option, “Grout Easy” by Aldon Corp., or equal water-based, water soluble product may be used prior to installing porous and quarry tile.
F. Correct detrimental conditions before proceeding with installation.

3.2 WATERPROOFING MEMBRANE

A. General: Application: Comply with the waterproofing membrane manufacturer’s instructions, ANSI A 108.13, and the following.
B. Surface preparation:

1. Mask adjacent areas not to be waterproofed.
2. Prepare surfaces to be waterproofed so that they are clean, smooth and free of contamination.
3. Repair defects such as honeycombs, rock pockets, cracks, gaps, penetrations and protrusions. Remove glaze from concrete as recommended by the waterproofing manufacturer.
4. Prime/seal concrete and vertical substrates.

C. Apply waterproofing in 2 coats when substrate temperature is above 40-degrees F.
D. Install reinforcing fabric, where recommended by the waterproofing manufacturer, in waterproofing liquid at drains, coves, corners, over cracks and gaps in substrate.
E. Avoid interruptions during installation of membrane; if interrupted, clean interface surfaces to assure adhesion.
F. Completed membrane shall be uniform in thickness and texture, monolithic and waterproof.
G. Keep traffic on completed membrane to a minimum. Cover traffic path until tile is installed.
H. Set tile no sooner than 24 but no more than 72 hours after membrane installation.

3.3 GENERAL TILE INSTALLATION REQUIREMENTS

A. General: Install proprietary materials in compliance with their manufacturer's instructions. Press or beat the tiles to obtain 90 percent coverage of mortar on back of tile, except for the following which requires 100 percent coverage:

1. Tiles in "wet" areas.
2. Edges and corners of all tiles regardless of location.
3. Back butter tile if necessary.

B. Environmental conditions: Maintain minimum temperature limits and installation practices recommended by waterproofing membrane, mortar and grout materials manufacturers in areas where this work is performed.
C. Terminations: Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignment. Saw-cut and drill tiles to obtain tight fitting, clean, sharp, undamaged cut edges.

1. Rub cuts smooth with fine abrasive stone.
2. Cut and drill so that electrical outlets, plumbing fixtures, pipes, fixtures and fittings standard plates, escutcheon and collars will overlap the tile.
3. Do not cut or split tile at penetrations.

D. Visual requirements:

1. Install tile in patterns indicated with uniform joints and perimeter units not less than 1/2 unit wide. Adjust to minimize cutting.
2. Accurately set tile with flush well-fitted joints, finished in true planes, plumb, square, sloped or level as required.
3. Form corners, returns, and exposed tile edges with approved trimmers.
4. Where tiles selected by the Architect are installed in the same plane, but are of a different thickness, it is the Contractor responsibility to adjust the setting bed or mortar thickness so that all tiles are flush.
5. Under no circumstances will glazed tile installations be accepted if any part of unglazed tile body remains exposed after tile is installed.
6. Provide matching tile trimmers of all types required to prevent such condition.

E. Tolerances: Maximum deviation from true lines and levels shall not exceed 1/8-inch in 10 feet for floors, and 1/8-inch in 8-foot for walls.
F. Sealant: Calk penetrations in tile with sealant and backing rod specified in Section 07 92 00. Provide movement joints where indicated or as recommended by TCNA Method EJ171-13.
G. Tile blending:

1. For tile exhibiting color variations within the ranges selected during sample submittals, verify that tiles have been factory-blended and packaged accordingly so that tiles taken from one package show the same color range as those taken from other packages, and match approved Samples.

2. If not factory-blended, either return to manufacturer or blend tiles at Project site before installing.

H. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE INSTALLATION METHODS

A. Walls: TCNA W244Cwith waterproof membrane.
B. Toilet Room floors: TCNA F113, with waterproof/crack-isolation membrane.
C. Showers: TCNA W244C with continuous waterproof/crack-isolation membrane.

3.5 GROUTING/CURING

A. Grouting: Comply with ANSI A108.10. Finish joints of square edge tiles flush with tile surfaces; finish joints of cushion edge tiles to depth of cushion. Finish grout free of voids and pits.

1. Fill epoxy-filled joints flush with tile edges. The epoxy will cure to a slight depression.

3.6 SEALANTS

A. Comply with sealant manufacturer's instructions and ASTM C 1193.
B. Install backing rod and fill joints completely with sealant tooled below surface of tile. Do not disturb until fully cured.

3.7 FIELD QUALITY CONTROL

A. Plug drains and dam door and other openings after waterproofing is installed and flood the floor with approximately 2-inch of water.

1. Let the water stand undisturbed for 48 hours and check for leaks.
2. Repair discovered leaks and retest; repeat as necessary to stop leaks before proceeding with tile installation

3.8 CLEANING/PROTECTING

A. Cleaning:

1. Clean tile and repair faulty grouting. Sponge and clean surfaces with clean water and soft brushes.
2. Polish glazed tile after cleaning with clean, dry cloths.

B. Protect completed installations until acceptance by the Owner.
C. Protect floor tiles with reinforced Kraft paper or other heavy covering securely taped in place during the construction period to prevent damage and stains. Remove protection when no longer needed.
D. When recommended by tile manufacturer, apply a coat of neutral protective cleaner to completed tilework.
E. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
F. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.
G. Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tiles.

END OF SECTION

SECTION 09 51 13 - ACOUSTICAL CEILING TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Acoustical ceiling panels (ACT-1, ACT-2 and ACT-3).
2. Metal suspension system.

B. Related requirements:

1. Other Section of Division 09 for metal suspension systems for gypsum board ceilings.
2. Divisions 21 and 26 for mechanical and electrical work in acoustical ceilings.

1.2 SUBMITTALS

A. Shop drawings:

1. Show ceiling layouts, seismic bracing (lateral and vertical), method of suspension where interference such as ducts and pipes exists, with light fixtures, grilles, sprinkler heads, speakers accurately located, and typical details of constructions and installation.
2. Where pipes, ducts and conduits prevent direct suspension, and trapezes have to be used, justify the suspension system with structural calculations.
3. Reproduction of the Contract Drawings as Shop Drawings is not acceptable; take necessary measurements at the job site.

B. Data:

1. Manufacturer product specifications and installation instructions for ceiling materials, and suspension system.
2. Include satisfactory test data certifying that the acoustical units comply with Code requirements.
3. Evidence that acoustical units comply with Code for flammability, combustibility and toxicity.

C. Samples:

1. Full size acoustical units showing the full range of color and texture to be expected in the completed work. Where actual size exceeds 2 ft by 2 ft, provide 2 ft by 2 ft samples.
2. Twelve-inch long Samples of each linear component of the suspension systems and Samples of connectors.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.

6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

E. Warranty: Proposed warranty form.
F. Closeout: Manufacturer recommendations for cleaning and refinishing ceiling materials, including precautions against materials and methods that may be detrimental to finishes and acoustical performances.
G. Seismic restraint: Include calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 QUALITY ASSURANCE

A. Design criteria: Suspension system shall have a “Heavy Duty” classification when tested in compliance with ASTM C 635.
B. Sample panel:

1. Install a 10-foot square sample panel of the acoustical ceiling for the Architect's approval before proceeding with this work.
2. Locate where directed by the Architect in the building.
3. Do not proceed with remainder of this work until Architect’s approval is obtained.
4. The finished work shall match approved sample panel and, if properly identified for future reference, may remain a part of the finished work, when approved by the Architect.

1.4 HANDLING

A. Delivery: Deliver UL labeled cartons of acoustical units bearing label classification of acoustical and flammability characteristics.
B. Storage:

1. Store acoustical panel cartons open at each end to stabilize moisture content and temperature, in fully enclosed space(s), in well-ventilated area protected from weather, moisture, soiling, extreme temperatures and humidity.
2. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handling: To avoid chipping edges or otherwise staining or damaging units.

1.5 JOB CONDITIONS

A. Do not install acoustical ceilings until the space to receive them is enclosed and weathertight, until work above ceilings is completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

B. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.
C. Do not use ceiling panels in extreme or continuous high humidity, or areas exposed directly to weather or water.
D. Allow time for dimensional changes in ceiling panels stored at temperature/humidity conditions well outside of those recommended for service; with increases in temperature/humidity, these products expand (up to 1/64-inch/foot at 85-degree F and 90 percent RH) and may not fit into a fixed grid.

1.6 SPECIAL WARRANTY

A. Submit a warranty, on manufacturer's letterhead, stating that manufacturer agrees to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical panels: Sagging and warping.
2. Grid system: Rusting and manufacturer's defects.

B. Warranty period:

1. Acoustical panels: 10 years from date of Substantial Completion.
2. Grid: 10 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Design ceiling components to ensure that light fixtures and installed accessories will not induce concentrated loads.
B. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.
C. Design ceiling components to limit deflection of completed ceilings to L/360.

2.2 ACOUSTICAL UNITS

A. See ACT-1, ACT-2 and ACT-3 on sheet A610 -Interior Finish Materials sheet.
B. Manufacturers:

1. Basis of Design: Armstrong World Industries.
2. Or equal. Other manufacturer's products must meet similar specified quality and be approved by Architect.

C. Acoustical tile:

1. NRC rated 0.75: Equal to CALLA by Armstrong World Industries.
2. NRC rated 0.55: Equal to CANYON by Armstrong World Industries.

2.3 SUSPENSION SYSTEM

A. Grillage:

1. Configurations as indicated, Silhouette 1/8" XL by Armstrong World Industries, basis of design.

    a. USG Corp.
    b. Chicago Metallic Corp.
    c. Or equal.

2. See Drawings for type of systems required.
3. Components die-cut and interlocking.
4. Cope cross runners to lay flush with main runners, except at edge moldings.

B. Hanger wires: Galvanized carbon steel, ASTM A 641 soft-temper, prestretched, yield-stress load of at least 3 times design load, 12-gage minimum.

C. Accessories:

1. Devices for attachment to overhead construction, secondary members, splines, splicers, connection slips, wall connectors and all other accessories required for a complete installation.
2. Field assembled compression post (strut):

    a. Cold-or hot-rolled angles, steel studs, EMT or rigid conduit, or black iron.
    b. Cold-rolled steel section with maximum L/R ratio of 200.

3. Engineered compression struts: As an alternate to compressions struts indicated above, manufactured compression struts may be provided when installed in compliance with their manufacturer's instructions.

    a. Description: Pre-engineered telescoping seismic compression posts made from heavy-wall galvanized tubing.
    b. Products: "Donn Brand Compression Post VAS" by USG Interiors, Inc., or equal by Armstrong World Industries.

D. Trim:

1. As required by details, construction, and compatible with design and appearance of ceiling.
2. Provide perimeter trim not less than 2 inches wide at tile support point.
3. Perimeter trim and trim in ceiling penetrations shall permit lateral adjustment of at least 1/2-inch to accommodate irregularities in vertical surfaces interrupting ceiling.

E. Finish:

1. Concealed ferrous metal surfaces: Galvanized, cadmium-plated or coated with a factory-applied rust-inhibitive paint.
2. Exposed metal surfaces: Prime and apply a satin baked-on enamel finish matching the color of the acoustical units, as approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. General:

1. Install materials in compliance with the approved Shop Drawings, the Specifications, and the ceiling panel and suspension system manufacturers' instructions. In case of conflict, the most stringent provisions apply.
2. Comply with ASTM C 636 and E 580, governing regulations and industry standards applicable to this work.
3. Install materials so that the sound insulation of adjacent construction materials and assemblies is not compromised by locally reducing their surface mass, or creating unsealed penetrations.
4. Plan layout to balance border widths at opposite edges of each ceiling area.
5. Avoid use of less than half-width acoustical units wherever possible.
6. Comply with reflected ceiling plans shown on the Contract Drawings.

3.3 SUSPENDED GRILLAGE INSTALLATION

A. Anchor hanger wires to overhead construction as indicated on the Drawings.
B. Attach hanger wires at not more than 4-foot o.c. along each member supported directly from hanger, with a hanger not more than 8 inches from wall and end of each member.
C. Hang ceiling system independent of walls, columns, pipes, ducts, and conduits, and their insulation; maintain minimum distance from end of grid to wall of 3/4-inch.
D. Do not attach wires to, or bend around, interfering material such as ductwork, pipes and conduits. Provide trapeze or equivalent devices where obstructions interfere with direct suspension.
E. Connection device from vertical wire to the structure above must sustain, without failure, a minimum of 100 lb. load.
F. Assemble and install metal grillage so that it is rigid, square, and free of lateral movement, level within the tolerances specified, with hairline, flush joints at abutting members, and with all members accurately aligned. Grid connection to perimeter must be attached on 2 adjacent walls.
G. Tie perimeter Tee ends together
H. Provide seismic bracing as indicated, (splay wires or rigid bracing) within 2 inches of intersection and splayed 90-degree apart at 45-degree angle.
I. Install perimeter and edge trim level with flush, hairline joints:

1. Screw-attach trim to studs at not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8-inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

J. Tolerance of completed grillage shall be limited to 1/8-inch for entire ceiling in each area.

3.4 ACOUSTICAL UNITS

A. Match tile for color and pattern by using tile from cartons in the same sequence as manufactured.
B. Scribe and cut acoustical units for accurate fit at borders and around work which penetrates ceilings. Install with flush, tight joints.

C. For square-edged units, install units with edges fully hidden from view by flanges of suspension system runners and moldings.
D. For reveal-edged units on suspension system runners, install units with bottom of reveal in firm contact with top surface of runner flanges.
E. For reveal-edged units on suspension system members with box-shaped flanges, install units with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
F. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.
G. Duplicate Tegular edges at partial panels with straight, square cuts.

3.5 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.6 FIELD QUALITY CONTROL

A. Remove and replace units that are damaged or cannot be cleaned, to the Architect's satisfaction.

3.7 CLEANING

A. Clean soiled acoustical units and their suspension systems in compliance with their manufacturer's instructions.

END OF SECTION

SECTION 09 52 00 – ACOUSTICAL CEILING PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Acoustic ceiling board system (ACP).
2. Fasteners, and other miscellaneous supports and accessories required for a complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, fire alarm systems and fire sprinklers.

1.3 SUBMITTALS

A. Manufacturer's data:

1. Manufacturer's product specifications and installation instructions for materials and attachment system, including certified laboratory test reports and other data required to show compliance with these Specifications and Code.
2. Include manufacturer's recommendations for cleaning and refinishing panels, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

B. Shop drawings: Large scale, dimensioned Shop Drawings showing panel layout on all horizontal areas to be covered. Coordinate with other trades and show penetrations through boards.

C. Samples: 24-inch square Samples of each type of panel with finished edges and each typical fastener to be used.

D. Test data: Satisfactory test data certifying that panel flammability, flame spread and smoke developed will satisfy Code requirements.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Installer qualifications: Firm with a minimum of 3 years documented experience installing similar acoustical panels as those specified for the Project.

C. Regulatory requirements and approvals:

1. Surface Burning of Core Material (tested to UL 723, or CAN/ULC-S102-M):

   a. Flame spread 25, smoke developed 50.

2. Water vapor sorption - by weight (Tested to ASTM C1104):

   a. <3% at 120oF (49oC) at 95% relative humidity.

3. Minimum Compressive Strength (Tested to ASTM C165):

   a. 3 lb. Density

      1) At 10% deformation: 25 lb/ft2.
      2) At 25% deformation: 90 lb/ft2.

4. Fungi resistance: Meets all requirements of ASTM C1338

D. Mockup: Where directed, construct a mockup of the ceiling panels inside the building, as directed by the Architect.

1. Finish mockup as specified.
2. Make corrections requested by the Architect, or remove and replace mockup when the corrective work is not acceptable.
3. The approved mockup may remain a part of the finish work, when authorized by the Architect, and will be used as a standard for the remainder of the acoustical panel work.

1.5 HANDLING

A. Storage:

1. Coordinate the delivery of the panels with their installation to minimize storage periods at the site.
2. Protect panels from excessive moisture in shipment, storage and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation.
3. Do not deliver material to building until "wet work" such as concrete and plaster have been completed and cured to a condition of equilibrium.

1.6 JOB CONDITIONS

A. Do not begin installation until spaces to receive panels are enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity, in the space, as recommended by panel manufacturer.
B. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.

1.7 MAINTENANCE

A. Furnish maintenance stock consisting of 5 panels taken from the same "run" as that used for the Project.
B. Carefully pack the maintenance stock in heavy cardboard cartons, with the contents clearly marked. Include complete manufacturer's cleaning instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standard density of 3.0 pcf.
B. Available in 2-inch thickness.
C. Product shall have a resilient composition with good resistance to damage from job-site impact.
D. Be dimensionally stable with no capability for shrinking or warping.
E. Be composed of inorganic glass fibers.

F. Product's mat face shall be able to be cleaned by vacuuming.
G. Not be susceptible to rot or mildew contamination.
H. Not cause corrosion greater than caused by sterile cotton to steel and aluminum,
I. When tested in accordance with ASTM C665.

1. Acoustical Performance (Tested to ASTM C423, Type A mounting)

Product	Density	Thickness	Octave Band Center Frequencies, Hz						
	Pcf (kg/m3)	In (mm)	125	250	500	1000	2000	4000	NRC
SelectSound Acoustic Board	3.0 (48)	1.0 (25)	0.05	0.25	0.61	0.94	1.06	0.86	0.70
		2.0 (51)	0.25	0.73	1.08	1.11	0.99	0.99	1.00

2.2 MANUFACTURERS

A. Basis of Design: ACP as listed on Interior Finish Materials on Drawings.
B. Or equal.

2.3 ACCESSORIES

A. Fasteners as shown on detail 2/A901.

PART 3 - EXECUTION

3.1 EXAMINATION/COORDINATION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.
B. Coordinate this work with installation of furring strips specified in Division 09.

3.2 PREPARATION

A. Measure each under deck surface area and establish layout of acoustical ceiling units, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
B. Coordination: Furnish layouts for preset inserts, clips, and other wall anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Install panels in accordance with their manufacturer's published instructions, the approved Shop Drawings, plumb and level, as applicable, with hairline, flush joints, undamaged edges, and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations.
B. Attach panels securely to their supports.

3.4 FIELD QUALITY CONTROL

A. Remove improperly installed panels and replace with new panels.

B. Clean soiled or discolored surfaces after installation. Touchup with same paint used for factory-finishing.
C. Replace panels damaged beyond satisfactory field repair, as determined by the Architect, with satisfactory panels at no cost to the Owner.

3.5 ADJUSTING AND CLEANING

A. Replace damaged and broken wall panels.
B. Clean exposed surfaces of acoustical walls, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any wall panels that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

SECTION 09 64 66 - WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the complete installation, sanding and finishing of the wood performance flooring in the Assembly Room and Spec Class Lab (WF-1 & WF-2).

B. Related work specified under other sections.

1. Concrete and Concrete Finishing: Section 03 30 00.

a. Concrete Slab Depression: a total of 3-inches with 25/32-inch flooring.
b. Surface Finish: steel troweled and finished smooth.
c. Concrete Tolerance: +/- 1/8-inch in radius of 10-feet. High spots shall be ground level and low spots shall be filled in with approved leveling compound by the general contractor to meet the tolerance above.
d. Compressive Strength: Concrete shall be a minimum of 3,000 psi and a maximum of 4000 psi compressive strength after 28 days.

1) Concrete shall be free of washed river gravel, pea gravel, flint or hardener additives. No lightweight concrete.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting:

1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, Sub-Contractor.
2. Review substrate conditions, requirements of related work, requirements for operation of HVAC system, installation instructions, storage and handling procedures, and protection measures.
3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.
4. Distribute minutes to attendees within 48 hours.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings:

1. 3/8-inch = 1 ft. 0-inches, large scale, dimensioned Shop Drawings showing flooring layout, details of installation, size and location of control joints, interface with other materials, and details of edges.
2. Take measurements at site for Shop Drawings; do not scale the Drawings.

C. Concrete substrate guidelines:

1. Submit MFMA Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive wood flooring.
2. Submit Robbins Technical Services “Concrete Guide Specification” for further information regarding conditions and requirements of concrete prior to installation.

D. Sample: Submit 3 sample of the complete MVP system. Sample to be made by the manufacturer and so indicated. When approved, one sample will be returned to the Contractor

1. Minimum Size: 12-inches square.

2. Finish to demonstrate final product.

E. Submit copy of Maintenance Instructions.

1.4 QUALITY ASSURANCE

A. Floor System Manufacturer Qualifications

1. Manufacturer shall be an established firm experienced in field and have been in business or a minimum of 10 years, Robbins, Inc. or an approved equal.
2. Manufacturer will be a member in good standing of the Maple Flooring Manufacturers Association (MFMA).

B. Floor Contractor/Installer Qualifications and Certifications

1. Flooring contractor shall be a firm experienced in flooring field and accredited/approved by flooring manufacturer.
2. Submit a list of at least three completed projects of similar magnitude and complexity.

C. Site applied finishes must be within South Coast Air Quality Management District (SCAQMD) mandated VOC limits,

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials

1. Materials shall not be delivered, stored or installed until all masonry, painting, plastering tilework, marble and terrazzo work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit (13 to 27 degrees Celsius) and relative humidity of 35-50% are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied
2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

1.6 JOB CONDITIONS-SEQUENCY

A. Do not install floor system until concrete has been cured 60 days and the requirements in paragraph 1.4 A are obtained.

B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.

C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit (13 to 27 degrees Celsius) and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.

D. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or owner requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by owner (or owner’s agent) of complete gymnasium floor.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE REQUIREMENTS

A. Floor System Performance Requirements

1. Surface Appearance:

a. Expansion spaces will not exceed 1/64-inches at time of installation and will be spread evenly across the floor with each row of flooring.
b. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).

2. The wood flooring shall be MFMA-FJ maple.
3. Maple Flooring shall been tested in accordance under California Department of Public Health/EHLB/Standard Method Version 1.2, 2017 and been found to be in compliance with the standard.
4. The use of power-actuated or pneumatic anchoring systems is not allowed. The floor system must be anchored using the drilled and pinned method.
5. Steel anchor channels shall be of double flange design and run continuously along the length of the sleeper.
6. Subfloor and metal channel design shall be constructed in a fashion to prevent the over anchorage of the flooring system.
7. System subfloor shall be made from nominal 23/32-inches APA rated sheathing.

2.2 MANUFACTURER

A. Basis of Design: WF-1 and WF-2; See Interior Finish Materials in Drawings.

B. Robbins Bio-Channel Classic floor system by Robbins, Inc.

C. Or equal.

2.3 MATERIALS

A. Vapor Barrier over concrete substrate: VersaShield® Moisture Suppression System or equal.

B. Subfloor

1. Robbins Bio-Channels: engineered-wooden sleeper with 7/16-inches EPDM Bio-Pads attached, factory encased in a steel channel. Sleeper must be free to move vertically within steel channel confines to assure proper uniformity of resiliency and function.
2. 23/32-inches structural APA rated sheathing, exposure 1.

C. Maple Flooring

1. 25/32-inches thick x 2-1/4-inches wide, 2nd & Better grade, Unfinished TGEM, KD Northern Hard Maple, Continuous Strip® XL Flooring as manufactured by Robbins and graded in accordance with MFMA-FJ rules. Flooring will have XLplus™ technology to reduce or eliminate routine spacing for expansion.
2. Specie: Northern Hard Maple
3. Seasoning: Kiln Dried (KD)
4. Matching: Tongue and groove side-match and end-match.(TGEM)
5. Type: Finger-Jointed (FJ)
6. Pattern: Straight-lay (One directional) Fasteners.
7. Flooring – 1-3/4-inch 15-gauge cleats or staples.
8. Subfloor

a. 1” length, 7/16-inch crown, coated staples or equivalent.
b. Construction adhesive, PL400 or equivalent.
c. Channel anchors – 3/16-inch x 2-inch steel concrete anchor.

9. Thickness: 25/32"

   a. Standard Continuous Strip XL product may be substituted for consistently low humidity regions.

D. Fasteners

1. Flooring – 1-3/4-inch barbed cleats or staples.
2. Subfloor - 1-5/8" to 1-3/4-inch subflooring nails or staples.
3. Channel anchors - 1-1/2-inch-long steel Powers SPIKE® anchors or Tapcons

E. Finishing materials

1. MFMA approved sealer.
2. MFMA approved finish.

F. Perimeter

1. 3" x 4" ventilating type. (brown)

G. Finishing Materials

1. Site applied sealers and finishes must comply with CDPH v1.1-2010 General Emissions Evaluation.
2. MFMA approved sealer and finish.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect concrete slab for proper tolerance and dryness and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8-inch in 10-feet. Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.

B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.

C. Subfloor shall be broom cleaned by general contractor.

D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.2 INSTALLATION

A. Vapor Barrier: Install polyethylene with joints lapped a minimum of 6-inches and turned up 4-inches at the walls.

B. Subfloors:

1. Place Bio-Channels 16-1/16-inches on center end-to-end staggering end joints in adjacent rows, perpendicular to the intended direction of the maple flooring. Gap the ends of the sleepers approximately 1/4-inch. Provide 1-1/2-inch to 2-inches expansion void at the perimeter and all vertical obstructions.
2. Anchor Bio-Channels at predetermined locations.

   a. Anchor sleepers in 3 of the pre-determined holes, at both ends and in center. When shimming for leveling is necessary, anchor in all 5 holes.
   b. If extensive shimming is necessary, alternate anchoring 'non-standard' method may be necessary. Additional costs for this 'non-standard' method are to be borne by the purchaser.

3. Install solid blocking at doorways, and at demountable partitions.

4. Install blocking per manufacturer's recommendations.
5. Install 23/32-inch plywood subfloor parallel to sleeper channels and securely fasten subfloor 6-inch on center along each channel sleeper.

C. Flooring: Machine nail maple finish flooring 10 to 12-inches O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Provide 2-inch expansion voids at the perimeter and at all vertical obstructions. Expansion rows will be evenly distributed with each row of flooring, with each space not exceeding 1/64-inch.

3.3 FINISHING

A. Sanding

1. Sand per manufacturer’s recommendations.
2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
3. Inspect entire area of floor to ensure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.
4. Vacuum and/or tack floor before first coat of seal.

B. Finishing

1. Floor should be clean and completely free of dirt and sanding dust.
2. Apply specified combination of seal, game line paint, and finish in accordance with manufacturer's instructions.
3. Buff and vacuum and/or tack between each coat after it dries.
4. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Game lines shall be painted between seal coats and finish coats. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by Architect.

3.4 WALL BASE INSTALLATION

A. Install Robbins vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corner.

3.5 CLEANING

A. Clean up all unused materials and debris and remove it from the premises

END OF SECTION

SECTION 09 65 10 - RESILIENT WALL BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Rubber base (RB-1 & RB-2).
2. Adhesive.

B. Related requirements: Other Sections of Division 09 for resilient flooring.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Pre-installation meeting:

1.3 SUBMITTALS

A. Samples: 12-inch long Samples of each type and color of base.
B. Data: Proof of compliance with specified requirements.

1.4 HANDLING

A. Store materials indoors at a temperature above 60-degree F for at least 24 hours before use.

1.5 JOB CONDITIONS

A. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.
B. Maintain temperature in spaces to receive resilient bases between 70-degree and 90-degree F for not less than 24 hours before and 48 hours after its installation.
C. Maintain minimum temperature of 60-degree F after bases have been installed, except as specified above.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See RB-1 aNd RB-2 on sheet A610 -Interior Finish Materials sheet.
B. Rubber bases at perimeter of wood floor: Vented rubber base with premolded corners, color selected by the Architect, 1/8-inch thick by 4-inch high with a 4-inch toe, by Johnsonite, Horner Flooring Co. or equal.
C. Rubber bases elsewhere:

1. One-eight-inch thick, by 4 or 6-inch high, ASTM F 1861, Type TS (thermoset vulcanized rubber), Group 1 (homogeneous).

2. Basis of Design: Johnsonite. Acceptable manufacturers include the following:

   a. Burke Flooring Products.
   b. Roppe Rubber Corp.
   c. Flexco Co.
   d. Mercer Products Co., Inc.
   e. Or equal.

3. Color(s) selected by the Architect.
4. Top set base where no flooring and resilient flooring occur; straight (carpet) base at all other locations; do not use preformed corners.
5. In rolls minimum 100-foot long. Walls 20-foot or less in one piece; do not use short pieces.
6. Base shall be from same batch and run number for each color.

D. Rubber Molding Accessories:

1. Description: Rubber cap for cove carpet cap for cove resilient floor covering carpet edge for glue-down applications nosing for carpet nosing for resilient floor covering reducer strip for resilient floor covering transition strips.
2. Manufacturer: By the manufacturer of the Rubber Base.

E. Adhesive: Type and brand recommended by base manufacturer for the conditions of use.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine walls for excessive moisture content and unevenness which would prevent the proper execution of the work of this Section. Fill cracks and sand down bumps.
B. Remove dirt, oil, grease, or other foreign matter from surfaces to receive bases.
C. Correct detrimental conditions before proceeding with installation.
D. Do not install bases until they are same temperature as space where they are to be installed. Move bases and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

3.2 ADHESIVE

A. Mix and apply adhesive in compliance with its manufacturer’s instructions.
B. Provide safety precautions during mixing and application as recommended by the adhesive manufacturer.
C. Apply adhesive uniformly over backing surfaces, but only on areas which can be covered by bases within the recommended working time of the adhesive.
D. Tape adjacent surfaces to prevent migration and misapplication of adhesive.
E. Remove adhesive which dries or films over. Do not soil walls, bases, and other adjacent surfaces with adhesive. Promptly remove spillage from adjacent surfaces without damaging those surfaces.

3.3 BASE INSTALLATION

A. At masonry surfaces, fill voids along top edges of base with base manufacturer’s recommended adhesive filler material.
B. Match edges at seams or double cut adjoining lengths. Install with hairline, flush butt joints.

C. Locate end of runs not less than 36 inches from a corner, except where impossible due to length of wall.
D. Do not use pieces less than 6-foot long, except where impossible due to length of wall.
E. Do not use preformed corner pieces, except for vented base.

1. Form inside corners on job from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate.
2. Form outside corners on job from straight pieces of maximum lengths possible by shaving back of base at point where bending will occur. Remove a strip perpendicular to length of base and only deep enough to produce a snug fit without bends whitening or removal of more than half the thickness of base.
3. Form without producing discoloration (whitening) at bends.

F. Scribe base accurately to abutting materials.

3.4 RUBBER MOLDING ACCESSORIES INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.
B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 FIELD QUALITY CONTROL

A. After adhesive sets, clean bases with a neutral cleaner recommended by the base manufacturer.
B. Verify that there are no open joints, and that base is completely adhered for its full length. Re-install in fresh adhesive where applicable.
C. Protect completed installations from damage until final acceptance.

END OF SECTION

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Luxury vinyl tile (LVT-1, and LVT-2) direct glue down tile.
2. Luxury vinyl tile (LVT-3) with acoustic installation.
3. Edging and reducer strips.
4. Accessories, and installation and finishing materials.

B. Related requirements: Section 09 65 10 for Resilient base.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting: Prior to start of installation, survey floors with the concrete finisher to verify acceptability of concrete substrate to receive flooring. Refer to Part 3 for corrective work.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data and test reports for the flooring and adhesive.
B. Samples: Full size Samples of each type of floor tile, and 12-inch long Samples of each linear material.
C. Tests: Moisture and pH tests results.
D. Closeout:

1. Furnish the Owner 2 copies of the tile manufacturer recommended maintenance products, and recommended maintenance methods and procedures.
2. Include precautions against cleaning materials and methods detrimental to finishes and their performance.

1.4 QUALITY ASSURANCE

A. Uniformity:

1. Provide tile, adhesive and maintenance materials from one manufacturer.
2. If required, provide accessories including leveling and patching compounds supplied from one manufacturer.

B. Installer: Firm competent in installation of resilient flooring, with a minimum of 5 years of successful experience installing flooring of the kind and scope specified.

1.5 HANDLING

A. Store materials indoors above 60 degrees F for at least 24 hours before use.

1.6 JOB CONDITIONS

A. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.
B. Maintain temperature in spaces to receive resilient flooring between 70 and 90 degrees F for not less than 24 hours before and 48 hours after installation.
C. Maintain minimum temperature of 60 degrees F after resilient flooring has been installed, except as specified above.

1.7 MAINTENANCE

A. Furnish the Owner one percent of the quantity of each type of plank installed on the Project, but not less than 1/2 box, properly boxed and labeled.
B. Coordinate selection of floor polish with the Owner's maintenance service.

1.8 SPECIAL WARRANTY

A. Manufacturer shall warrant materials and workmanship for 5 years and agree to make repairs and replacements due to faulty materials and workmanship during the warranty period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 RESILIENT PLANKS

A. See LVT-1 and LVT-2 direct glue down luxury vinyl tile on sheet A610 -Interior Finish Materials sheet.
B. See LVT-3 acoustic rated-luxury vinyl tile on sheet A610 -Interior Finish Materials sheet.

1. When tested in accordance with ASTM E90, E989 and E492, products must meet the following results:

a. Minimum STC: 56.
b. Minimum IIC: 59.

C. Manufacturer: Basis of design: Shaw Contract or equal.
D. Style: As shown on Sheet A610.
E. Color: See Interior Finish Materials on Drawings.
F. Thickness: 5 mm.

2.2 MATERIALS

A. ASTM F 1066, Composition 1, Class 2. ADA-compliant, with a coefficient of friction of finish flooring, with the applied finish, of 0.6 minimum when tested in compliance with ASTM D 2047.

2.3 ACCESSORIES

A. Accessories:

1. Edging and reducer strip: Tapered hard rubber edging strip made specifically for termination of resilient tile flooring, by Mercer Products Co., Inc., Macklanburg-Duncan, Johnsonite or equal of the color selected by the Architect.

2.4 ADHESIVES AND FLOOR FINISH

A. Primer, adhesive and crack filler: Type and brand recommended by floor covering manufacturer for the conditions of use.
B. Patching, smoothing, and leveling compound: As specified in Section 09 65 15.
C. Floor finish: Commercially available product acceptable to flooring manufacturer which, when cured, shall have a coefficient of friction of 0.6 or greater when tested in accordance with ASTM D 2047.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Prepare substrates according to adhesive manufacturer's instructions and the following to ensure adhesion of floor coverings.
B. Concrete: Prepare according to ASTM F 710.

1. Verify that substrate is dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Perform alkalinity and adhesion tests recommended by manufacturer. Proceed with installation only after substrates passes testing.
4. Moisture testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869, or equivalent test recommended by the flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 square foot in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

5. Check pH level and correct until it is within range recommended by the adhesive manufacturer.
6. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
7. Level surfaces to be covered with flooring by grinding bumps and filling-in depressions to a tolerance an overall value of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17. Use fill material compatible with both substrates.

C. Sweep and vacuum clean substrates to be covered with flooring before installation.

D. Move resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation. Do not install resilient flooring until materials are the same temperature as space where they will be installed.
E. Correct other detrimental conditions before proceeding with installation.

3.2 ADHESIVES

A. Mix and apply adhesives in compliance with their manufacturer's instructions.
B. Apply adhesive uniformly over backing surfaces, but only on areas that can be covered by flooring material within the recommended working time of the adhesive.
C. Remove adhesive that dries or films over. Do not soil adjacent surfaces with adhesive, and promptly remove spillage without damaging those surfaces.

3.3 PLANKS

A. Match units for color and pattern, when applicable, by using units from cartons in the same sequence as manufactured and packaged.
B. Install units working from centerlines of each room or space and work outward towards the perimeter. Lay out units so none are less than 1/2 the width of a full size.
C. Fit units neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under metal thresholds and around permanent fixtures and equipment.
D. Lay units in grid pattern with the patterns running in the same direction, parallel to room axis in straight lines, except where impractical because of room shape.
E. As units are installed and within adhesive’s recommended working time, roll floor with a clean, smooth, 100-pound roller in both directions.

    1. As the rolling proceeds, replace loosened, defective, or damaged tile with new and finish to the specified condition.
    2. Take particular care to roll edges and corners thoroughly.

F. Acoustic installation at LVT-3:

    1. Adhere a sheet of 2 mil polyethylene plastic to substrate with spray adhesive.
    2. Apply troweled on adhesive to plastic sheet as recommended by LVT manufacturer.
    3. Install foam-backed flooring.

3.4 REDUCER AND EDGING STRIPS

A. Install reducer and edging strips at termination of floor tile where tile is not covered by another material. Glue securely to clean, dry subfloor.
B. Install in one piece between door jambs, and in longest possible length elsewhere with no piece less than 6 feet long.
C. Butt tightly to resilient tiles, where applicable, and scribe accurately to doorframe and other abutting surfaces.

3.5 FINISHING/CLEANING/PROTECTING

A. Protect flooring against mars, marks, indentations, and other damage immediately after installation and polishing.
B. Use protection methods recommended by flooring manufacturer.
C. Do not move heavy and sharp objects directly over resilient flooring. Place hardboard panels over flooring and under objects being moved. Slide or roll objects over panels without moving panels.

D. Cover traffic paths with undyed, untreated building paper taped securely in place. Remove at final cleaning.
E. Apply protective polish to floor surfaces that are free from soil, visible adhesive and surface blemishes.
F. Clean resilient floors not more than 4 days before dates scheduled for inspections intended to establish Substantial Completion in each area of the Project.

1. If required to restore polish finish, and if recommended by flooring manufacturer, strip protective floor polish applied after completing installation before cleaning.
2. After cleaning, reapply polish to floor to restore floor finish according to flooring manufacturer instructions. Coordinate with Owner's maintenance program.

G. Remove and replace materials that are damaged or cannot be cleaned.

END OF SECTION

SECTION 09 78 00 - FRP WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fiberglass reinforced polyester (FRP-1) wall panels.
2. Matching moldings, fasteners, adhesive, and sealant.

B. Related requirements: All other sealants.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Preinstallation meeting:

1.3 SUBMITTALS

A. Samples: 12-inch square Samples of panel and 12-inch lengths of each profile of moldings.
B. Shop Drawings: Shop Drawings showing panel joint locations and details. Joint locations are subject to the Architect’s approval.
C. Data: Manufacturer Product Data including testing laboratory certification of fire hazard classification on each package.
D. Maintenance instructions:

1. Copy of the panel manufacturer’s maintenance instructions.
2. Include recommended cleaning materials and methods of application therefore together with precautions in cleaning materials' use if such are improperly applied.

1.4 HANDLING

A. Store panels indoor, and flat to avoid distortion. Maintain storage area temperature above 60-degree F.

1.5 JOB CONDITIONS

A. Comply with wall panel manufacturer recommendations for temperature and humidity in installation areas.
B. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See FRP-1 on sheet A610 -Interior Finish Materials sheet.

B. FRP wall panel: By one of the following, furnished in longest length available to minimize joints, of the color selected by the Architect.

1. Marlite Standard FRP panels, P 100 white, pebbled finish, basis of design.
2. Fire-X Glasbord by Crain Composites.
3. Sequentia Inc.
4. Or equal.

C. Trim: Manufacturer standard vinyl division bar, insider corner, outside corner and cap as required, matching the color of wall panel.
D. Fasteners: Manufacturer standard rivets matching the color of the wall panel.
E. Adhesive: Titebond “Fast Grab”, or equal non-toxic, non-allergenic adhesive recommended by the wall panel manufacturer and meeting Code requirements for flammability and toxicity.
F. Sealant: White, low gloss silicone, as specified in Section 07 92 00 unless otherwise recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces scheduled to receive wall panel for conditions that will adversely affect execution, permanence and quality of work. Verify that substrates are:

1. Clean, smooth, dry, free of irregularities.
2. Straight within a maximum tolerance of 1/8-inch in 10 feet, and not greater than 1/16-inch each running foot.

B. Correct detrimental conditions before proceeding with installation.

3.2 MOLDING INSTALLATION

A. Provide molding at top and bottom edges of panels. Use full-length stock moldings for run equaling, or less than, the stock length. Miter corners.
B. Butt vertical edges tight and flush.
C. Install panels plumb and level, and with hairline joints.

3.3 INSTALLATION OF PANELS

A. Except as modified in this Section, comply with the panel manufacturer's installation instructions.
B. Establish the top of the wainscot, or vertical terminations, in a straight line.
C. Avoid contamination of panel faces.
D. Butt joints for an even and tight fit along entire length of joint. Make joints plumb and level.
E. Balance sheet width symmetrically about centerline of wall so that no sheet is less than 2-foot wide.
F. Glue panels securely to substrate.
G. Square cut and sand smooth edges that will not be covered by trim. Do not damage exposed face.
H. Carefully locate penetrations and openings through the panels, including electrical outlets and piping, and provide minimum sized openings as required. Size openings so they will be covered by switch plates, flanges and other required trim.

3.4 CLEANING

A. Remove excess sealant and adhesive from joint immediately.

B. Clean installation immediately after installation with manufacturer recommended cleaner.
C. Replace damaged or permanently contaminated units.

END OF SECTION

SECTION 09 84 13 – ACOUSTICAL IMPACT RESISTANT FABRIC WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes high NRC acoustic wall panel systems (AWP-1, AWP-2, AWP-3 and AWP-4).
B. Installation accessories.
C. Related Requirements:

1. Section 09 84 33 for sound absorbing wall panels.

1.2 SYSTEM DESCRIPTION

A. High NRC acoustical wall systems are manufactured from domestic cementitious wood fiber. Built-in furring pieces with factory-filled panels provide maximum sound control and install faster

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination of Work: Coordinate work with installers of related work including, but not limited to building insulation, gypsum board, fire annunciation systems, mechanical systems, electrical systems, and wall sprinklers.

1.4 SUBMITTALS

A. Manufacturer’s data:

1. Manufacturer product specifications and installation instructions for materials and attachment system, including certified laboratory test reports and other data required to show compliance with these Specifications and approval by authorities giving jurisdiction.
2. Include manufacturer recommendations for cleaning and refinishing fabric, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

B. Shop drawings:

1. Large scale, dimensioned shop drawings showing panel layout on all surfaces to be covered by the work specified herein, location of wall brackets and clips, and location of electrical outlets.
2. Identify abutting materials, supporting materials, and fabric orientation.

C. Verification Samples:

1. Fabricated samples of each type of panel specified; 12 x 12 in, showing construction, edge details.
2. Mounting Devices: Full size samples, 12 -inches long.

D. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit certified test reports from recognized test laboratories.
2. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than 5 years of experience in manufacturing acoustical products similar to those specified.
B. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
C. Mockup: Where directed, construct a mockup of each different type (4 total) of wall panels inside the building, as directed by the Architect.

1. Finish mockup as specified.
2. Make corrections requested by the Architect or remove and replace mockup when the corrective work is not acceptable.
3. The approved mockup may remain a part of the finish work, when authorized by the Architect, and will be used as a standard for the remainder of the acoustical panel work.

1.6 HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles.
B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.
C. Store cartons open at each end to stabilize moisture content and temperature.
D. Protect panel edges from damage.

1.7 SITE CONDITIONS

A. Environmental Requirements:

1. Do not install acoustical panels until building is closed in and HVAC system is operational.
2. Locate materials on-site at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

B. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:

1. Relative Humidity: 65 - 75%.
2. Uniform Temperature: 55 - 70 degrees F.

C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

1.8 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Defects in materials or factory workmanship.

B. Acoustical panels and suspension systems one source manufacturer is 30 years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Noise Reduction Coefficient (NRC) ASTM C 423:

a. 1-inch thick-0.90.
b. 1-inches thick- 1.00.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. UL Classified Flame Spread: ASTM E 1264; Class A.
2. Provide acoustical panel system which has been manufactured, fabricated and installed to provide the following acoustical ratings:

2.2 ACOUSTICAL WALL PANELS

A. Manufacturer:

1. Basis of Design: AWP-1, AWP-2, AWP-3 and AWP-4: See sheet A610 -Interior Finish Materials sheet.
2. Fabric wrapping: See A610 -Interior Finish Materials sheet.
3. Or equal.

B. Wall Panels:

1. Acoustic Core: 18 lbs, high density, 1/8 inch thick fiberglass board laminated to a 6-7 lbs Fiberglass core.
2. Edge Type: Fabric wrapped, resin hardened.
3. Edge Detail: Square.
4. Corner Detail: Square.
5. Thickness: 1 and 2-inches as indicated.

C. Width: As shown on elevations and as required to fit the locations.

D. Length: As shown on elevations,

2.3 ACCESSORIES

A. Secure aluminum Z-clips to wall and panels as recommended by panel manufacturer.

2.4 FABRICATION

A. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 in for thickness, overall length and width, and squareness from corner to corner.

EXECUTION

2.5 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.
B. Do not proceed with installation until all wet work such as concrete, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

2.6 PREPARATION

A. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall area to receive panels. Avoid use of less than half width units at borders and comply with reflected ceiling plans.
B. Coordinate panel layout with mechanical grilles and electrical switches/cover plates.
C. Coordination: Furnish layouts for preset inserts, clips, and other wall anchors whose installation is specified in other sections.

2.7 INSTALLATION

A. Install panels in accordance Drawings and manufacturer’s installation instructions.
B. Align panels accurately, with edges plumb and top edges level.
C. Scribe to fit accurately at adjoining work and penetrations.
D. Align panels accurately, with edges plumb and top edges level. Suspend ceiling baffles at locations and heights indicated.
E. Install panels to construction tolerances of plus or minus 1/16-inch for the following:

1. Plumb and level.
2. Flatness.
3. Width of joints.

2.8 CLEANING

A. Clean facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.
B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

2.9 PROTECTION

A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION

SECTION 09 84 33 - ACOUSTICAL PERFORATED WOOD WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Custom fabricated acoustical perforated wood wall panels (AWP-5, AWP-6 and AWP-7).
2. Fasteners, hangers, wall brackets and other accessories for a complete installation.

B. Related requirements:

1. Section 09 84 13 for acoustical impact resistant fabric wrapped wall panels.
2. Division 26 for flush plates at electrical receptacles and outlets, fire annunciation devices, light fixtures, thermostats and other wall mounted devices.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and fire alarm systems.

1.3 SUBMITTALS

A. Manufacturer’s data:

1. Manufacturer product specifications and installation instructions for materials and attachment system, including certified laboratory test reports and other data required to show compliance with these Specifications and approval by authorities giving jurisdiction.
2. Include manufacturer recommendations for cleaning and refinishing fabric, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

B. Shop drawings:

1. Large scale, dimensioned shop drawings showing panel layout on all surfaces to be covered by the work specified herein, location of wall brackets and clips, and location of electrical outlets.
2. Identify abutting and supporting materials.

C. Samples:

1. Typical panel with finished edges, large enough to demonstrate typical and special conditions, but not less than 12-inch square.
2. Samples of clips.

D. Data:

1. Manufacturer product data, dimensions, and specifications.

2. Manufacturer recommended installation instructions and procedures.

E. Test data:

1. Manufacturer sound absorption data based on sound absorption tests and calculations in accordance with the latest editions of ASTM C 423, Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method and ASTM E 795, Standard Practices for Mounting Specimens during Sound Absorption Tests conducted by a laboratory accredited for specific acoustical testing under the National Voluntary Laboratory Accreditation Program (NVLAP).
2. Laboratory test data showing proposed product has been tested in accordance with ASTM C 423 and ASTM E 795 and has met or exceeded specified Noise Reduction Coefficient (NRC) rating required.
3. Satisfactory acoustical test data to verify that acoustical wall panels meet criteria specified.
4. Complete, unedited test reports for panel system prepared by an independent testing laboratory indicating full compliance with both acoustical and fire resistance performance requirements.

    a. Fire tests shall be for a complete assembly, including perimeter and longitudinal butt joint framing extrusions, core material, and fabric covering as required by Appendix X of ASTM E 84 (NFPA 255).
    b. Complete test reports for fabric covering prepared by an independent testing laboratory indicating compliance with specified fire resistance performance requirements.

F. Certificates: Provide certification from manufacturer of panels attesting to their product's compliance with specified requirements including fire performance characteristics.

G. Warranty: Proposed warranty form.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panels from a single manufacturer with at least 5 years of prior experience fabricating projects of similar size and complexity.

B. Installer qualifications: Firm with a minimum of 3 years documented experience installing similar acoustical panels as those specified for the Project.

C. Fire Performance Characteristics: Class A as tested by an independent accredited testing facility. Tests: ASTM E84. Flame spread: 25 or less. Smoke developed: 450 or less as specified by state or local codes.

D. Mockup: Where directed, construct a mockup of the acoustical wall panels inside the building. Make panel full height by 8-foot wide.

1. Finish mockup as specified.
2. The Architect will review the mockup under various light conditions for defects and improperly finished joints. Provide a portable light for that purpose when so requested.
3. Make corrections requested by the Architect or remove and replace mockup when the corrective work is not acceptable.
4. The approved mockup shall remain in the building until its removal is directed, or its incorporation into the Work is authorized by the Architect and will be used as a standard for the remainder of the acoustical panels.

1.5 HANDLING

A. Storage:

1. Coordinate the delivery of the acoustical panels with their installation to minimize storage periods at the site.
2. Protect acoustical panels from excessive moisture in shipment, storage and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation.
3. Do not deliver material to building until "wet work" such as concrete and plaster have been completed and cured to a condition of equilibrium.

B. Handling: White gloves recommended for handling to avoid marring, especially on light color panels.

1.6 JOB CONDITIONS

A. Environmental conditions:

1. Do not begin installation until spaces to receive acoustical panels are enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy.
2. Maintain temperature and humidity, in the space, as recommended by panel manufacturer.

B. Illumination: Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform the work and as will occur in the room or space after the building is in operation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustic Performance: To generate the standing sound waves required for resistive absorption, each panel must have an acoustically reflective back surface that extends the panel’s full length and width. Each panel must achieve a minimum NRC test value as stated without any cavity space or back loading:

1. AWP-5 and AWP-6: Latus WP-RFM-25 (1” thick) .90 NRC
2. AWP-7: Latus WP-RFM-51 (2” thick) 1.0 NRC

2.2 MANUFACTURER/PANEL TYPE

A. See AWP-5, AWP-6 and AWP-7 on sheet A610 -Interior Finish Materials sheet.
B. Or equal.
C. Acoustical Performance is tested per ASTM C423

1. Wall Panel

a. Real perforated wood veneer laminated to a fiberglass reinforced polymer or a UV printed/painted surface applied to an MDF skin. Surface skin thickness shall not be

less than 1.5mm (0.060”). The core of the panels shall be comprised of a Class A sintered resin-reinforced glass wool.

1) Panels will be furnished with perforated faces consisting of 0.5 mm (0.02”) diameter holes in an offset pattern. The perforations must be clean without rounded edges or grain pull out between perforations. A minimum of 99.5% of the perforations must be acoustically functional, providing unobstructed passage into the core. Perforations must maintain consistent diameter through the face material and backer with no tapering or roughness.

b. Reveal Type: Closed, 1/4-inch by 1/4-inch with matching wood spline.
c. Panel Thickness: As indicated on Drawings.
d. Z-Clip to Z-Bar.

2.3 WOOD PANEL FINISH

A. See Sheet A610 Interior Finish Materials for species.
B. Cut: quarter-cut.
C. Matching Veneer leaves: Slip-matching.
D. Matching between panels: Natural sequence.
E. Finish: Factory finished, North American Architectural Woodwork Standards System-5, Varnish, Conversion.

2.4 ACCESSORIES

A. Clear anodized aluminum Z-Clips mounted to wall and panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
C. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Measure each wall area, establish layout of acoustical panels. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. Comply with the panel manufacturer's instructions, the approved shop drawings, and the following.

1. Install panels plumb, level, with hairline, flush joints, undamaged edges, and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations.

2. Install panels securely so that individual panels can be removed without affecting and damaging adjacent panels.

B. Install panels to construction tolerances of plus or minus 1/16-inch for the following:

1. Plumb and level.
2. Flatness.
3. Width of joints.

3.4 CLEANING/REPLACING

A. Clean soiled or discolored panels after installation.
B. Remove damaged or improperly installed panels and replace with new panels.
C. Replace fabric and panels damaged beyond satisfactory field repair with satisfactory materials.

END OF SECTION

SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Painting and finishing all interior and exterior exposed surfaces throughout the Project, except as excluded in Paragraphs B and C below.
2. Surface preparation, priming and coats of paint specified herein are in addition to shop priming and surface treatment specified in other Sections.
3. Paint all exposed surfaces whether or not colors are designated, except where the natural finish of the material is obviously intended or specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.
4. This Section also includes sealing joints between surfaces to be painted, except for joints designed to be expressed in the Work and joints between a natural finish and a painted surface.
5. Section also includes preparation of existing surface to be painted and painting these surfaces.

B. Painting specified elsewhere:

1. Shop priming of ferrous metal items included under miscellaneous metal fabrications, hollow metal work, and similar work.
2. Deck coating.
3. Finished (not primed) mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, except as specified in Article 3.4 below.
4. Prefinished glazed assemblies, including skylights.
5. Pavement markings.
6. Toilet compartments and screens.
7. Exterior wall louvers.
8. Flagpoles.
9. Signage.
10. Postal equipment.
11. Loading dock equipment.
12. Parking control equipment.
13. Piping identification.

C. Painting not included: Do not paint the following surfaces.

1. Insulation and its facing.
2. Wood flooring.
3. Concrete and CMU.
4. Sprayed fireproofing.
5. Roofing.
6. Steel decking.
7. Chain link partitions.
8. Finish hardware, except those items noted USP.
9. Flexible door and window seals and weatherstripping (paint exposed metal to match door frame).
10. Finished metal surfaces such as anodized aluminum, stainless steel, chromium-plating, copper, bronze, brass and similar finished materials will not require finish painting.

11. Painting is not required on walls or ceilings in concealed and inaccessible areas, such as furred areas, pipe spaces, duct shafts and elevator shafts.
12. Operating parts, labels and nameplates:

    a. Do not paint moving parts of operating units, mechanical and electrical parts, such as valve and damper operator linkages, sinkages, sensing devices, motor and fan shafts.
    b. Do not paint over any nameplates, Code required labels, such as UL and FM, or any equipment identification, performance rating, name, or nomenclature plates.

1.2 DEFINITIONS

A. Paint: The term, as used in this Section, means all coating system components, including primers, emulsions, enamels, varnishes, stains, lacquers, sealers, fillers, and other applied materials whether used as prime, intermediate or finish coat.
B. Definitions of painting terms: ASTM D 16, unless otherwise specified.
C. Dry film thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000-inch).
D. Sheen: The terms used in these Specifications refer to the following gloss ranges when tested in accordance with ASTM D 523 test method.

Name	Test Method	Gloss Range
Flat	60-degree meter	0 to 7
Low sheen	60-degree meter	10 to 15
Eggshell	60-degree meter	25 to 30
Semi-gloss	60-degree meter	55 to 60
Gloss	60-degree meter	85 to 90

E. Coat: As used in this Section means a layer of paint, varnish, lacquer, or other material applied, then allowed to dry. To backroll or apply a wet-on-wet film still constitutes a single coat.
F. Finish: As used in this Section means the entire coating system including the texture, color, and sheen of a surface.
G. Refinish: As used in this Section implies a new finish will be applied to a surface that has been finished as defined above.
H. Touchup: As used in this Section means correction of deficiencies in the specified work to achieve a properly painted surface.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Phasing: Program cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

1.4 SUBMITTALS

A. Materials:

1. Copies of a complete materials list, identified by manufacturer name and product label or stock number.
2. Prepare list in the form of a repetition of the specified paint finishes, with the addition of the specific product intended for each coat.

B. Color samples:

1. Eight-and-one-half- by 11-inch samples of each color for painted finishes.

2. Provide stepped samples, defining each separate coat, including block fillers and primers. Identify paint system on back of control Samples.
3. Use representative colors when preparing samples for review.
4. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
5. For transparent finishes, prepare the samples on wood specie, which will be used for the Project; 12-inch for lumber; 12-inch square for veneered panels.
6. Resubmit until required sheen, color, and texture are achieved.

C. Data: Manufacturer product data as follows.

1. Data for paint products, including paint label analysis, application instruction, and VOC content in grams/liter.
2. Duplicate copies of manufacturer affidavit with each shipment of materials delivered to the job site certifying that each material furnished complies with specified requirements.

1.5 QUALITY ASSURANCE

A. Painter’s qualifications: Firm and individuals experienced in applying paints and coatings similar in material, design, and extent to those specified for the Project, whose work has resulted in applications with a record of successful in-service performance.
B. SCAQMD Rule 1113: Submit paint manufacturer's certificate stating that provided coatings meet or exceed current SCAQMD Rule 1113 requirements.
C. Mockups:

1. Apply sample paint finishes (approximately 10-foot square) of each color scheme to wall areas, as directed by the Architect. Refer to Section 09 24 00 for painting cement plaster mockup and to Section 09 29 00 for painting gypsum board mockup.
2. Obtain Architect's approval of mockups before proceeding further. Approved mockups will be used as a standard for the Project, and if properly identified may remain a part of the Work.
3. Final acceptance of colors will be from job-applied samples.

1.6 JOB CONDITIONS

A. Environmental requirements:

1. Comply with paint manufacturer’s recommendations for environmental conditions and the following.
2. Provide adequate heating and ventilating to maintain environmental conditions recommended by paint manufacturer.
3. Do not apply finish in areas where dust is being generated.
4. Apply paint under the following prevailing conditions.

    a. Air and surface temperatures are not below 40-degree F. or above 120-degree F.
    b. Surface temperature is at least 5-degree F. above the dew point.
    c. When there is not threat of impending rain.

B. Protection:

1. Protect adjacent whether being painted or not against damage from painting operation. Correct damage by cleaning, repairing, replacing, and repainting, as approved by Architect, and leave in an undamaged condition.
2. Use protective methods and materials, including temporary covering, recommended in writing by deferred (finish) flooring manufacturer.

3. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work. Post signs immediately after painting.
4. Provide drop cloths, shields, barricades and other protection necessary to safeguard adjacent surfaces not to be painted.
5. Provide and maintain protection as required to protect finished work from damage until its acceptance.

C. Illuminate work area during painting to provide the same or greater level of illumination required to properly perform the work and will occur in the room or space after the building is in operation.

1.7 HANDLING

A. Store materials indoors and mix only in spaces suitable for such purpose. Protect adjacent surfaces when mixing.
B. Store paint containers so the manufacturer's labels are clearly visible.

1.8 WARRANTY

A. Color of exterior surfaces painted, as part of the work of this Section shall, at the end of one year, have remained free from serious fading when compared to a control sample of the original paint.
B. Interior and exterior paint shall have its original adherence at the end of one year and there shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at the end of this period.
C. Washing painted surfaces with alkali-free soap and water shall remove surface dirt from painted surfaces without producing deteriorating effects.

1.9 MAINTENANCE MATERIAL

A. With closeout submittals deliver one identified unopened gallon of each type and color of paint material used on the Project to the Owner for future paint touchup.
B. In addition to manufacturer label, identify with room number, floor or area, type of paint, color and sheen, as applicable, for future identification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specified and approved manufacturers:

1. Catalog names and numbers refer to products manufactured or distributed by the Vista Paint Corp. Dunn Edwards Corp. and Sherwin Williams, except as otherwise specified.
2. Equivalent acceptable products by Benjamin Moore, and PPG may be substituted when approved by the Architect.

2.2 PAINT

A. General:

1. Provide coating systems meeting or exceeding current SCAQMD Rule 1113 requirements.
2. Biocide content shall not exceed 0.025 percent by weight or volume.

3. Paint shall not contain fungicides or bactericides classified as mercury acetates, phenol phenates, or phenol formaldehyde.
4. Water-based paints shall not be formulated or manufactured with chemicals listed by Green Seal to be hazardous including, but not limited to, formaldehyde, halogenated solvents, aromatic hydrocarbons, mercury, and mercury compounds.
5. Paints shall not be tinted with pigments of lead, cadmium, chromium, and their oxides.

B. Quality and manufacture: Insofar as practicable, each paint shall be factory-mixed to match approved samples and colors, and be of a consistency permitting immediate application. Use best quality grade regularly manufactured by one of the manufacturers listed in the schedule at the end of the Section.

C. Clear interior wood coatings: McCloskey's, Sikkens and Deft
D. Paint uniformity and compatibility:

1. Box at the job site or factory-batch paint to ensure color uniformity and consistency. This includes the required maintenance materials.
2. Provide finish coats compatible with the prime coats used.

a. Review other Sections of these Specifications, in which prime coats are specified, and manufacturer data for shop-primed surfaces to be painted.
b. Be responsible for the compatibility of the total coating system.

3. Provide barrier coats over incompatible primer or remove and reprime.
4. Products of more than one approved manufacturer may be used, except that all products applied on a surface shall be by the same manufacturer.

2.3 MISCELLANEOUS MATERIALS

A. Joint sealant: Paintable sealant as specified in Section 07 92 00.
B. Galvanized etching product: One of the following.

1. Jasco Prep N Prime.
2. Oakite 747 LTS.
3. Henkel Galvaprep 5.

2.4 COLOR SCHEDULE

A. Refer to the Finish and Materials Schedule for paint colors.
B. The Architect will prepare a color schedule with samples for guidance in painting.
C. The Architect may select, allocate, and vary colors and sheens on different surfaces throughout the Work, subject to the following:

D. Exterior work: A maximum of 5 different colors will be used, with variations for trim, doors, miscellaneous work, and metal work.
E. Interior work: A maximum of 15 different pigmented colors will be used, with variations for trim and wall surfaces and wainscots.
F. Dark tones: A maximum of 10 dark tones will be used as accent colors for interior.
G. Deep tones or accent colors will not exceed 10 percent of surfaces to be painted, unless indicated otherwise.
H. Number of colors to be used will be determined by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be painted for conditions that would adversely affect the permanence and quality of this work.
B. Correct unsuitable conditions before proceeding with painting.

3.2 SURFACE PREPARATION

A. General: Prepare surfaces to receive the specified finishes in compliance with the paint manufacturer's instructions and the following. Extend painting on all surfaces visible from any angle.
B. Galvanized steel: Comply with American Galvanizers Association recommendations, ASTM D 2092, ASTM D 6386 - 10 Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting, and the following.

1. Clean with commercial phosphoric acid solution or one of the products named above for pretreatment or by brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1.5 to 2 mils.
2. Recoat within the time limit recommended by the primer manufacturer.

C. Shop-primed metal: Remove oil, grease, dirt and foreign matter. Spot prime abraded surfaces with compatible primer.
D. Shop-painted metal: Sand to provide a mechanical bond with field applied finishes, or use a commercial preparation specifically formulated to improve paint bond.
E. Unprimed ferrous metal: Remove rust, mill scale, oil and other foreign matter.
F. Aluminum: Remove foreign matters and clean with mineral spirit.
G. Factory-primed equipment: Repair damaged primer; remove rust and clean to bright metal where appropriate. Sand or etch primer to permit bonding of finish coats. Clean surfaces thoroughly before applying additional coats.
H. Plaster, concrete and CMU:

1. Clean surfaces of dirt, laitance, encrustations and foreign matter. For concrete, comply with SSPC-SP13, "Surface Preparation of Concrete."
2. In plaster and concrete, patch cracks, holes, pits and other imperfections, not patched under other Sections, flush and smooth with adjacent surfaces.
3. Do not apply sealer or paint when the moisture content of the surfaces to be painted exceeds 8 percent.
4. Touchup suction spots after priming with an additional prime coat until all surfaces show a uniform coating.

I. Gypsum board:

1. Remove dust, loose particles or other matter that would prevent proper paint adhesion.
2. Check to see that joints and screw heads are properly covered with joint compound and sanded smooth and flush with adjacent surfaces.

J. Wood:

1. Sandpaper smooth and dust clean. Remove handling marks and raised grain.
2. Fill nail holes, cracks and depressions with wood filler , colored to match finish for wood scheduled to receive a transparent finish. Use a tack cloth on wood to receive a transparent finish to remove sanding dust.

K. Other materials not covered above: Prepare to receive paint in compliance with the paint manufacturer instructions.

L. Existing painted surfaces:

1. General:

   a. Wash surfaces with biodegradable detergent to remove dirt, dust and contaminants. Rinse clean. Use bleach on mildew; remove mildew completely.
   b. Patch dents, gouges and other imperfections in painted surfaces and sand smooth and flush with adjacent undamaged surfaces so that patching will be invisible after painting.
   c. Remove dust, rust and other surface contaminates, loose and unsound paint coatings, etc. as required to provide clean and sound surfaces to receive new paint.
   d. Remove gloss from enamel paints with steel wool or by treating them with a commercial de-glosser used in compliance with its manufacturer's instructions.
   e. Where paint is missing, damaged, or dented and where bare substrate is exposed, remove all surfaces contamination and featheredge all edges to zero. Sand surfaces smooth and prime.
   f. Additionally, paint that is loose or is not otherwise tightly adhered to the substrate must be removed back to sound paint and down to the substrate, and all edges feathered to zero. When 40 percent or more of the paint on a given substrate is loose, damaged, or otherwise unsound, all the paint down to the substrate must be removed.

2. Wood:

   a. Verify that substrate is smooth and free of dirt, oil, and other foreign substances, while knots shall be seasoned, clean, dry, and sealed.
   b. Holes and imperfections must be filled with putty or plastic wood filler and sanded smooth, with the edges, ends, faces, undersides, and backsides primed.
   c. There shall be neither signs of steel wool (used for smoothing) nor blue stain.

3. Galvanized surfaces:

   a. Clean of soil, cement spatter, weld flux and spatter, oil grease, grime, and other surface dirt.
   b. Additionally, repair damaged zinc coating on galvanized surfaces with high zinc content cold-galvanizing repair.
   c. Remove grease, oil, dust, grime, and loose dirt are removed;
   d. Abrade surfaces sufficiently and roughen to provide a sound-anchoring base for new paint.

4. Rust: Remove down to bright metal and prime surfaces with rust-inhibitive primer.
5. Test: Test a small area of the previously painted finish with the new coating by applying to specified thickness and then continuing the test for the manufacturer's recommended published length of time before re-coating. If the previously painted surface blisters, wrinkles, dissolves, and/or delaminates, it will not work with the new finish. Where the previously painted surface is incompatible with the finish coat, one should apply a proper barrier coat to the prime coat. It is important to allow the manufacturer's suggested drying time between the succeeding coat, and to check the film of the previous coat be certain it is cured.

M. Hardware:

1. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be painted, or provide surface- applied protection prior to surface preparation and painting.
2. Coat cutouts for hinges, edges of lockset holes and same as for first coat.
3. Following completion of painting each space or area, reinstall the removed item by workmen skilled in the trades involved.

N. Fire extinguishers and fire hose cabinets: Apply 2 coats of paint finish, inside and out, matching finish and color of adjoining areas, unless otherwise noted for directed.
O. Weatherstripping and sound seals. Paint exposed metal surfaces to match the door frame, whether or not unfinished, furnished with factory prime coat, or factory treated for paint adhesion.
P. Access doors and panels: Generally, paint the same color as surrounding walls and ceiling.
Q. Registers: Paint exterior of register same color as adjacent wall. Paint interior of connected duct flat black for a distance of 18 inches.

3.3 PAINT PREPARATION

A. Open paint containers only as required for use. Mix paint in designated areas.
B. Thoroughly stir and agitate paint to uniformly smooth consistency suitable for proper application.
C. Do not reduce, change or use any materials except in compliance with manufacturer printed instructions.
D. In all cases, prepare and handle paint to prevent deterioration and inclusion of foreign matter.

3.4 APPLICATION

A. General:

1. Seal interior joints between wood or wood composite materials, trim, baseboard, molding, and casements and adjacent materials with paintable sealant specified in Section 07 92 00.
2. On prefinished wood doors, finish bottom after trimming and cutouts with 2 coats of high solids clear urethane varnish promptly upon delivery to the jobsite. This requirement applies also to plastic laminate faced doors.
3. Where the 2 faces of doors differ in color or finish, finish the edges to match the face visible when the door is open.
4. Apply paint only under conditions that will insure finishes free from blemishes and defects. Leave corners with no undue amount of paint buildup.
5. Use a slightly different shade for each coat of paint so that it may be readily identified.
6. Primer and intermediate coats shall be unscarred and completely integral when succeeding coats are applied. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
7. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
8. Remove paint spillage and spatters on adjacent surfaces so as not to damage the surface being cleaned.

a. Perform patching and repairs required because of painting operations.
b. Refinish entire panel or assembly where portion of finish has been damaged or is not acceptable to the Architect.

9. Paint interior surfaces of ducts, where visible thru registers and grilles, with a flat nonspecular black paint.
10. Unless otherwise directed by the Architect, spray-paint exposed surfaces of ceiling diffusers, air return grilles, speakers and other electrical and mechanical items, except smoke detectors and sprinkler heads, in painted ceilings to match the ceilings, whether these items are primed or factory-finished.
11. Number of coats:

    a. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.
    b. The number of coats specified is the minimum required for complete coverage and uniformity of color.
    c. Apply additional coats when undercoats, stains, or other conditions show through the final finish until the finish is of uniform color and appearance.

12. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
13. Paint interior surfaces, which are a continuation of exterior surfaces, subject to exterior exposure (such as an out-swinging door), with the applicable exterior coating system.
14. For opaque finishes, Completely cover surfaces to be painted to provide an opaque, smooth surface film uniform in finish, color, appearance, and coverage. Painted surfaces with cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness and other imperfections are not acceptable. Cut paint in sharp lines and color breaks.
15. For transparent finishes, apply multiple coats to produce a glass-smooth surface film of even luster, free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.
16. Completed work shall match approved samples, as determined by the Architect. Remove, refinish, or repaint work not complying with specified requirements.

B. Labeling rated (fire and smoke walls and partitions): Identify both sides of rated walls and partitions above finished and decorative ceilings (plenum) with minimum 2-inch high, bright red letters spaced at 10 feet o.c. maximum, as follows. Identification can be painted using a stencil or by using pre-printed self-adhesive labels.

1. Fire rated partitions: "FIRE PARTITION - DO NOT PENETRATE."
2. Smoke barrier partitions: "SMOKE PARTITION - DO NOT PENETRATE."

C. Painting fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security work: Paint the following and their hangers and accessories where exposed to view:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Ductwork.
5. Metal conduit.
6. Plastic conduit.
7. Tanks that do not have factory-applied final finishes.

D. Application method: Contractor's option provided applied coatings match approved samples. The Architect reserves the right to require that paint be sprayed for smoothness and uniformity.

E. Priming:

1. Prime bare metal scheduled to be painted, and not embedded in concrete and masonry, immediately upon delivery to the site.
2. Time lapse between priming and application of second coat shall be as short as possible.

F. Shop-primed metal:

1. Apply 2 finish coats of paint to match adjoining surfaces, as directed by the Architect, to shop primed mechanical and electrical equipment. This work includes but is not limited to interior of fire hose cabinets, air grilles, ceiling diffusers, electrical and telephone panels, and access panels.
2. Paint conduits, outlets and pull boxes, and mechanical equipment exposed to view, such as covered and uncovered piping and ductwork, pumps, compressors, air conditioning equipment and tanks as specified in this Section.
3. Paint the back side of access panels, removable or hinged covers to match the exposed surfaces.

G. Miscellaneous painting: Surfaces to be painted and not specifically described herein, shall be painted with a product specifically manufactured or prepared for the material and surface to be painted with a prime and 2 finish coats.

3.5 TOUCHUP/CLEANING

A. At completion of construction activities of other trades, touchup and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 PAINT FINISH SCHEDULE

A. Finish all surfaces in compliance with the following schedule. Catalog names and numbers refer to products by the Vista, Dunn Edwards, Sherwin Williams, Monochem and Carboline except as otherwise specified.

END OF SECTION

SECTION 09 90 00A – PAINT FINISH SCHEDULE

1.1 EXTERIOR SURFACES

A. Wood: 100 percent Acrylic Flat

1. Primer (1 coat):

a. 4200 Terminator II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 2000 Duratone by Vista Paint.
b. EVSH10 Evershield by Dunn-Edwards.
c. Duration Flat K32 Series by Sherwin-Williams.

B. Wood: 100 percent Semi-Gloss Acrylic

1. Primer (1 coat):

a. 4200 Terminator II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree SG by Vista Paint.
b. EVSH50-0 Evershield SG by Dunn-Edwards.
c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

C. Wood: 100 percent Gloss Acrylic

1. Primer (1 coat):

a. 4200 Terminator II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8500 Carefree Gloss by Vista Paint.
b. EVSH60-0 Evershield GL by Dunn-Edwards.
c. Duration Gloss K38 Series by Sherwin-Williams.

D. Wood: Semi-Transparent Stain

1. 2 Coats:

a. Olympic Maximum Semi-Transparent Stain by Vista Paint.
b. Okon WPT-3 Semi-Transparent Stain by Dunn-Edwards.

SuperDeck Exterior Waterborne Semi-Transparent Stain, SD3T00015 by Sherwin-Williams.

E. Concrete and Brick: 100 percent Acrylic Flat

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. Loxon Concrete & Masonry Primer/Sealer, A24W8300 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 2000 Duratone by Vista Paint.
b. EVSH10 Evershield by Dunn-Edwards.
c. Duration Flat K32 Series by Sherwin-Williams.

F. Portland Cement Plaster: 100 percent Acrylic Flat

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. Loxon Concrete & Masonry Primer/Sealer, A24W8300 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 2000 Duratone by Vista Paint.
b. EVSH10 Evershield by Dunn-Edwards.
c. Duration Flat K32 Series by Sherwin-Williams.

G. CMU: 100 percent Acrylic Flat

1. Primer (1 coat):

a. 018 Acrylic Block Filler by Vista Paint.
b. SBPR00 Blocfil by Dunn-Edwards.
c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 2000 Duratone by Vista Paint.
b. EVSH10 Evershield by Dunn-Edwards.
c. Duration Flat K32 Series by Sherwin-Williams.

H. CMU: 100 percent Acrylic Elastomeric

1. Primer (1 coat):

a. 018 Acrylic Block Filler by Vista Paint.
b. SBPR00 Blocfil by Dunn-Edwards.
c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 1900 Weather Master at 8 to 10 MILS per coat DFT by Vista Paint.
   b. DE Enduralastic, 10 EDLX10-0 Elastomeric at 11 to 13 MILS per coat DFT by Dunn-Edwards.
   c. Loxon XP, A24W1451 at 8 to 10 MILS per coat DFT by Sherwin-Williams.

I. CMU, Concrete, Brick: Graffiti-Resistant Coating (Permanent Matte Flat)

1. See Section 09 96 23

J. Painted Surfaces

1. Finish Coat (2 coats):

   a. Monochem 6100 Clear or 6150 Pigmented TDFT Base at 4-6 MILS by Vista Paint.
   b. Monochem 6100 Clear or 6150 Pigmented TDFT Base at 4-6 MILS by Dunn-Edwards.
   c. Monochem 6100 Clear or 6150 Pigmented TDFT Base at 4-6 MILS by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Vista Paint.
      Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Dunn-Edwards.
      Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Sherwin-Williams.

K. Clear Water Repellent

1. Monochem Aquaseal ME12 by Vista Paint.
2. Okon S-20 by Dunn-Edwards.
3. Loxon 7% Siloxane Water Repellent, A10T7 by Sherwin-Williams.

L. Unpainted Surfaces: Permanent (Matte Flat)

1. Finish Coat (2 coats):

   a. Monochem 6100 Clear Base at 4-6 Mils TDFT by Vista Paint.
      Monochem 6100 Clear Base at 4-6 Mils TDFT by Dunn-Edwards.
      Monochem 6100 Clear Base at 4-6 Mils TDFT by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Vista Paint.
      Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Dunn-Edwards.
      Monochem 5600 Permashield Premium at 4-6 MILS TDFT by Sherwin-Williams.

M. Iron and Steel: 100 percent Gloss Acrylic

1. Primer (1 coat):

   a. 9600 Protec Primer by Vista Paint.
   b. BRPR00 Block Rust by Dunn-Edwards.
   c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

    a. 8500 Carefree Gloss by Vista Paint.
    b. EVSH60-0 Evershield GL by Dunn-Edwards.
    c. Duration Gloss K38 Series by Sherwin-Williams.

N. Iron and Steel: 100 percent Semi-Gloss Acrylic

1. Primer (1 coat):

    a. 9600 Protec Primer by Vista Paint.
    b. BRPR00 Block Rust by Dunn-Edwards.
    c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

    a. 8400 Carefree SG by Vista Paint.
    b. EVSH50-0 Evershield GL by Dunn-Edwards.
    c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

O. Aluminum and Galvanized Steel: 100 percent Gloss Acrylic

1. Pretreat:

    a. Jasco Prep N Prime by Vista Paint.
    b. SCME-01 Supreme Etch by Dunn-Edwards.
    c. Great Lakes Clean & Etch by Sherwin-Williams.

2. Primer (1 coat):

    a. 4800 Metal Pro Primer by Vista Paint.
    b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
    c. Pro Industrial DTM Acrylic Primer/Finish, B66W11 by Sherwin-Williams.

3. Finish Coat (2 coats):

    a. 8500 Carefree Gloss by Vista Paint.
    b. EVSH60-0 Evershield GL by Dunn-Edwards.
    c. Duration Gloss K38 Series by Sherwin-Williams.

P. Aluminum and Galvanized Steel: 100 percent Semi-Gloss Acrylic

1. Pretreat:

    a. Krud Kutter by Vista Paint.
    b. SCME-01 Supreme Etch by Dunn-Edwards.
    c. Great Lakes Clean & Etch by Sherwin-Williams.

2. Primer (1 coat):

    a. 4800 Metal Pro Primer by Vista Paint.
    b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
    c. Pro Industrial DTM Acrylic Primer/Finish, B66W11 by Sherwin-Williams.

3. Finish Coat (2 coats):

   a. 8400 Carefree SG by Vista Paint.
   b. EVSH50-0 Evershield SG by Dunn-Edwards.
   c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

Q. Fiber Cement Board: 100 percent Acrylic Flat

1. Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. Loxon Concrete & Masonry Primer/Sealer, A24W8300 by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 2000 Duratone by Vista Paint.
   b. EVSH10 Evershield by Dunn-Edwards.
   c. Duration Flat K32 Series by Sherwin-Williams.

R. Zinc Alloy: 100 percent Semi-Gloss Acrylic

1. Pretreat:

   a. Krud Kutter by Vista Paint.
   b. SCME-01 Supreme Etch by Dunn-Edwards.
   c. Great Lakes Clean & Etch by Sherwin-Williams.

2. Primer (1 coat):

   a. 4800 Metal Pro Primer by Vista Paint.
   b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
   c. Pro Industrial DTM Acrylic Primer/Finish, B66W11 by Sherwin-Williams.

3. Finish Coat (2 coats):

   a. 8400 Carefree SG by Vista Paint.
   b. EVSH50-0 Evershield SG by Dunn-Edwards.
   c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

S. Ferrous Metal: Heavy Duty

1. Primer (1 coat):

   a. Carboline Carboguard 890 VOC at 5 MILS DFT by Vista Paint.
   b. Carboline Carboguard 890 VOC at 5 MILS DFT by Dunn-Edwards.
   c. Macropoxy 646-100 Fast Cure Epoxy, B58W620 at 5 MILS DFT by Sherwin-Williams.

2. Primer (1 coat):

   a. Carboline Carbothane 133MC at 5 MILS DFT by Vista Paint.
   b. Carboline Carbothane 133MC at 5 MILS DFT by Dunn-Edwards.
   c. Hi-Solids Polyurethane 100, B65-600 Series at 4 MILS DFT by Sherwin-Williams.

T. Gypsum Soffit Board: 100 percent Acrylic Flat

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 2000 Duratone by Vista Paint.
b. EVSH10 Evershield or Enduralastic 10 by Dunn-Edwards.
c. Duration Flat K32 Series or A80-1100 Series by Sherwin-Williams.

1.2 INTERIOR SURFACES

A. Wood: Low Sheen 100 percent Acrylic

1. Primer (1 coat):

a. 4200 Terminator II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8200 Carefree by Vista Paint.
b. SPMA20 Suprema Velvet Sheen by Dunn-Edwards.
c. Duration Matte A96 Series by Sherwin-Williams.

B. Wood: Semi-Gloss 100 percent Acrylic

1. Primer (1 coat):

a. 4200 Terminator II by Vista Paint.
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. ProBlock Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree Semi-Gloss by Vista Paint.
b. SPMA50 Suprema Semi-Gloss by Dunn-Edwards.
c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

C. Wood: ST Stain & Clear Lacquer Finish (275 g/liter VOC)

1. Primer (1 coat):

a. VWS0250 Series ST Stain by Vista Paint.
b. Old Masters Stain by Dunn-Edwards.
c. Minwax Water-based Wood Stain by Sherwin-Williams.

2. Primer (1 coat):

   a. NRS 1620 by Vista Paint.
   b. Contractor's Edge Sanding Sealer by Dunn-Edwards.
   c. Sher-Wood NC Lacquer Sealer, T65FV14 Sanding Sealer by Sherwin-Williams.

3. Primer (1 coat):

   a. NRF 1626 Satin Lacquer by Vista Paint.
   b. Contractor's Edge Sanding Sealer by Dunn-Edwards.
   c. Sher-Wood 275 Lacquer, T75FH100 Series by Sherwin-Williams.

D. Wood: Stained, Water White Finish (for light colored stains) (275 g/liter VOC)

1. Primer (1 coat):

   a. VW0250 Series ST Stain by Vista Paint.
   b. Old Masters Stain, Mission White Satin by Dunn-Edwards.
   c. Minwax Water-based Wood Stain by Sherwin-Williams.

2. Primer (1 coat):

   a. NAF 1420 Satin Sealer by Vista Paint.
   b. Contractor's Edge WW Sanding Sealer by Dunn-Edwards.
   c. Sher-Wood NC Lacquer by Sherwin-Williams.

3. Primer (1 coat):

   a. NAF 1426 Satin Lacquer by Vista Paint.
   b. Contractor's Edge Satin Lacquer by Dunn-Edwards.
   c. Sher-Wood 275 Lacquer, T75FH100 Series by Sherwin-Williams.

E. Wood: Varnish Flat Clear

1. Finish Coat (2 coats):

   a. McCloskey's 6701 Flat by Vista Paint.
   b. McCloskey's 6701 Flat by Dunn-Edwards.
   c. Minwax Water based Wood Stain by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. Varnish Satin Clear McCloskey's 6702 Satin by Vista Paint.
   b. Varnish Satin Clear McCloskey's 6702 Satin by Dunn-Edwards.
   c. Wood Classics Waterborne Polyurethane Varnish Satin by Sherwin-Williams.

3. Finish Coat (2 coats):

   a. Varnish Gloss Clear McCloskey's 6703 Gloss by Vista Paint.
   b. Varnish Gloss Clear McCloskey's 6703 Gloss by Dunn-Edwards.
   c. Wood Classics Waterborne Polyurethane Varnish Gloss by Sherwin-Williams.

F. Wood: Varnish Flat Clear

1. Finish Coat (2 coats):

a. DF 12 Dryfall Flat by Vista Paint.
b. AQUA10 Aquafall Dry Fall by Dunn-Edwards.
c. Waterborne Acrylic Dryfall Flat, B42W1 by Sherwin-Williams.

G. Rough Sawn Wood: Stain, Semi-Transparent

1. Finish Coat (2 coats):

a. Olympic Semi-Transparent Stain by Vista Paint.
b. Okon WPT-3 Semi-Transparent Stain by Dunn-Edwards.
c. Transparent Stain Waterborne Semi-Transparent Stain, SD3T00015 by Sherwin-Williams.

H. Concrete, Plaster, CMU: Flat Acrylic

1. Concrete Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Plaster Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

3. CMU Primer (1 coat):

a. 018 Acrylic Block Filler by Vista Paint.
b. SBPR00 Blocfil by Dunn-Edwards.
c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

4. Finish Coat (2 coats):

a. 8100 Carefree Flat by Vista Paint.
b. SPMA10 Suprema Flat by Dunn-Edwards.
c. Duration Flat A95 Series by Sherwin-Williams.

I. CMU, Concrete, Plaster: Eggshell Acrylic

1. Concrete Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Plaster Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

3. CMU Primer (1 coat):

   a. 018 Acrylic Block Filler by Vista Paint.
   b. SBPR00 Blocfil by Dunn-Edwards.
   c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

4. Finish Coat (2 coats):

   a. 8200 Carefree VS by Vista Paint.
   b. SPMA30 Suprema EG by Dunn-Edwards.
   c. Duration Matte A96 Series by Sherwin-Williams.

J. CMU, Concrete, Plaster: Semi-Gloss Acrylic

1. Concrete Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Plaster Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

3. CMU Primer (1 coat):

   a. 018 Acrylic Block Filler by Vista Paint.
   b. SBPR00 Blocfil by Dunn-Edwards.
   c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

4. Finish Coat (2 coats):

   a. 8400 Carefree SG by Vista Paint.
   b. SPMA50 Suprema SG by Dunn-Edwards.
   c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

K. CMU, Concrete, Plaster: 100 percent Acrylic

1. Concrete Primer (1 coat):

   a. 065 Acry-Prime by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series

by Sherwin-Williams.

2. Plaster Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

3. CMU Primer (1 coat):

   a. 018 Acrylic Block Filler by Vista Paint.
   b. SBPR00 Blocfil by Dunn-Edwards.
   c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

4. Finish Coat (2 coats):

   a. 8500 Carefree Gloss by Vista Paint.
   b. EVSH60 Evershield GL by Dunn-Edwards.
   c. Duration Gloss K38 Series by Sherwin-Williams.

L. Masonry: Gloss Acrylic Epoxy

1. Concrete Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Loc or Carboline 120 Primer with Carboline Sanitile 555 by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Plaster Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Super-Loc by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

3. CMU Primer (1 coat):

   a. 018 Acrylic Block Filler by Vista Paint.
   b. SBPR00 Blocfil by Dunn-Edwards.
   c. Loxon Block Surfacer, A24W200 by Sherwin-Williams.

4. Finish Coat (2 coats):

   a. S60 WB Gloss Epoxy at 2 to 3 MILS DFT by Vista Paint.
   b. S60 WB Gloss Epoxy at 2 to 3 MILS DFT or Carboline Sanitile 555 by Dunn-Edwards.
   c. Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300/B73V300 at 2 to 4 MILS DFT by Sherwin-Williams.

M. Gypsum Board: Flat

1. Finish Coat (2 coats):

a. 8100 Carefree Flat by Vista Paint.
b. SPMA10 Suprema Flat by Dunn-Edwards.
c. Duration Flat A95 Series by Sherwin-Williams.

N. Gypsum Board: Eggshell

1. Primer (1 coat):

a. 1100 Hi-Build PVA Primer by Vista Paint.
b. VNPR00 Vinylastic Primer by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Primer, B28W2600 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8200 Carefree Velva Sheen by Vista Paint.
b. SPMA30 Suprema EG by Dunn-Edwards.
c. Duration Matte A96 Series by Sherwin-Williams.

O. Gypsum Board: Low Sheen 100 percent Acrylic

1. Primer (1 coat):

a. 1100 Hi-Build PVA Primer by Vista Paint.
b. VNPR00 Vinylastic Primer by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Primer, B28W2600 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8300 Carefree Eggshell by Vista Paint.
b. SPMA40 Suprema Low Sheen by Dunn-Edwards.
c. Duration Satin A97 Series by Sherwin-Williams.

P. Gypsum Board: Semi-Gloss Acrylic

1. Primer (1 coat):

a. 1100 Hi-Build PVA Primer by Vista Paint.
b. VNPR00 Vinylastic Primer by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Primer, B28W2600 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree Semi-Gloss by Vista Paint.
b. SPMA50 Suprema Semi-Gloss by Dunn-Edwards.
c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

Q. Gypsum Board: 100 percent Gloss Acrylic

1. Primer (1 coat):

a. 1100 Hi-Build PVA Primer by Vista Paint.
b. VNPR00 Vinylastic Primer by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Primer, B28W2600 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8500 Carefree Gloss by Vista Paint.
b. EVSH60 Evershield Gloss by Dunn-Edwards.
c. Duration Gloss K38 Series by Sherwin-Williams.

R. Gypsum Board: Gloss Acrylic Epoxy

1. Primer (1 coat):

a. 1100 Hi-Build PVA Primer by Vista Paint.
b. VNPR00 Vinylastic Primer by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Primer, B28W2600 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. Carboline Sanitile 255 at 2 to 3 MILS DFT by Vista Paint.
b. Carboline Sanitile 255 at 2 to 3 MILS DFT by Dunn-Edwards.
c. Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300/B73V300 at 2 to 4 MILS DFT by Sherwin-Williams.

S. Plaster: Gypsum, Portland Cement, Flat

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8100 Carefree Flat by Vista Paint.
b. SPMA10 Suprema Flat by Dunn-Edwards.
c. Duration Flat, A95 Series by Sherwin-Williams.

T. Plaster: Gypsum, Portland Cement, Eggshell

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8200 Carefree Velva Sheen by Vista Paint.
   b. SPMA30 Suprema EG by Dunn-Edwards.
   c. Duration Matte A96 Series by Sherwin-Williams.

U. Plaster: Gypsum, Portland Cement, Semi-Gloss Acrylic

1. Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8400 Carefree SG by Vista Paint.
   b. SPMA50 Suprema SG by Dunn-Edwards.
   c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

V. Plaster: Gypsum, Portland Cement, Gloss 100 percent Acrylic

1. Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8500 Carefree Gloss by Vista Paint.
   b. EVSH00 Evershield GL by Dunn-Edwards.
   c. Duration Gloss A38 Series by Sherwin-Williams.

W. Particleboard, Hardboard: Flat

1. Primer (1 coat):

   a. 4600 Uniprime II by Vista Paint.
   b. ESPR00 Eff-Stop by Dunn-Edwards.
   c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8100 Carefree Flat by Vista Paint.
   b. SPMA10 Suprema Flat by Dunn-Edwards.
   c. ProMar 200 Zero VOC Interior Latex Flat, B30-2600 by Sherwin-Williams.

X. Particleboard, Hardboard: Semi-Gloss Acrylic

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree SG by Vista Paint.
b. SPMA50 Suprema SG by Dunn-Edwards.
c. ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 by Sherwin-Williams.

Y. Particleboard, Hardboard: Gloss 100 percent Acrylic

1. Primer (1 coat):

a. 4600 Uniprime II by Vista Paint.
b. ESPR00 Eff-Stop by Dunn-Edwards.
c. ProBlock Interior/Exterior Latex Primer/Sealer, B51-600 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8500 Carefree Gloss by Vista Paint.
b. EVSH60 Evershield GL by Dunn-Edwards.
c. Duration Gloss A38 Series by Sherwin-Williams.

Z. Ferrous Metal: Semi-Gloss 100 percent Acrylic

1. Primer (1 coat):

a. 9600 Protec Primer by Vista Paint
b. BRPR00 Block-Rust by Dunn-Edwards.
c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree SG by Vista Paint.
b. SPMA50 Suprema SG by Dunn-Edwards.
c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

AA. Ferrous Metal: Gloss 100 percent Acrylic

1. Primer (1 coat):

a. 9600 Protec Primer by Vista Paint
b. BRPR00 Block-Rust by Dunn-Edwards.
c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8500 Carefree Gloss by Vista Paint.
   b. EVSH00 Evershield GL by Dunn-Edwards.
   c. Duration Gloss A38 Series by Sherwin-Williams.

BB. Ferrous Metal: Heavy Duty

1. Primer (1 coat):

   a. Carboline Carboguard 890 VOC at 5 MILS DFT by Vista Paint.
   b. Carboline Carboguard 890 VOC at 5 MILS DFT by Dunn-Edwards.
   c. Macropoxy 646-100 Fast Cure Epoxy, B58W620 at 5 MILS DFT by Sherwin-Williams.

2. Primer (1 coat):

   a. Carboline Carbothane 133MC at 5 MILS DFT by Vista Paint.
   b. Carboline Carbothane 133MC at 5 MILS DFT by Dunn-Edwards.
   c. Hi-Solids Polyurethane 100, B65-600 Series at 4 MILS DFT by Sherwin-Williams.

CC. Aluminum: Semi-Gloss 100 percent Acrylic

1. Primer (1 coat):

   a. 9600 Protec Primer by Vista Paint
   b. BRPR00 Block-Rust by Dunn-Edwards.
   c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8400 Carefree SG by Vista Paint.
   b. SPMA50 Suprema SG by Dunn-Edwards.
   c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

DD. Aluminum: Gloss 100 percent Acrylic

1. Primer (1 coat):

   a. 4800 Metal Pro Primer by Vista Paint
   b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
   c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

   a. 8500 Carefree Gloss by Vista Paint.
   b. EVSH60 Evershield GL by Dunn-Edwards.
   c. Duration Gloss K38 Series by Sherwin-Williams.

EE. Stainless Steel, Copper, Brass: Semi-Gloss 100 percent Acrylic

1. Primer (1 coat):

   a. 4800 Metal Pro Primer by Vista Paint

b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8400 Carefree SG by Vista Paint.
b. SPMA50 Suprema SG by Dunn-Edwards.
c. Duration Semi-Gloss A98 Series by Sherwin-Williams.

FF. Stainless Steel, Copper, Brass: Gloss 100 percent Acrylic

1. Primer (1 coat):

a. 4800 Metal Pro Primer by Vista Paint
b. UGPR00 Ultra Grip Primer by Dunn-Edwards.
c. Pro Industrial Pro-Cryl Universal Primer, B66-310 Series by Sherwin-Williams.

2. Finish Coat (2 coats):

a. 8500 Carefree Gloss by Vista Paint.
b. EVSH60 Evershield GL by Dunn-Edwards.
c. Duration Gloss K38 Series by Sherwin-Williams.

GG. Fiberglass or Glass: (All Finishes)

1. Primer (1 coat):

a. XIM Clear Primer by Vista Paint
b. XIM Clear Primer by Dunn-Edwards.
c. Extreme Bond Bonding Primer, B51W150 by Sherwin-Williams.

2. Finish Coat (2 coats):

a. Finish as specified by Vista Paint.
b. Finish as specified by Dunn-Edwards.
c. Finish as specified by Sherwin-Williams.

HH. Acoustical Tile: Flat

1. Primer (1 coat):

a. 013 Acoustic Kote by Vista Paint
b. W 615 Acoustikote by Dunn-Edwards.

2. Finish Coat (2 coats):

a. 013 Acoustic Kote by Vista Paint.
b. W 615 Acoustikote by Dunn-Edwards.

II. Intumescent Paint on Plywood Backing Panel: Latex

1. Primer (1 coat minimum):

a. “Intumescent Latex” (thin film) by Contego International

b. "Flame Stop IM" by Flame Stop, Inc., or equal.

JJ. Concrete Epoxy Flooring System in Elevator Machine Rooms, and Electrical and Telephone Closets: Track blast or bead floor prior to application (ASTM D 4260)

1. Finish Coat (2 coats):

a. Carboline Carboguard 890 VOC at 5 MILS DFT by Vista Paint
b. Carboline Carboguard 890 VOC at 5 MILS DFT by Dunn-Edwards.
c. Armorseal 8100 Water Based Epoxy Floor Coating, B70-8000/B70V8100 Series by Sherwin-Williams.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Surface preparation and field application of high-performance coating systems to exterior steel surfaces, except for stainless steel and prefinished surface.
2. Establishing requirements for shop priming specified assemblies/materials. Coordinate surface preparation and shop priming with the requirements of this Section.

B. Related requirements:

1. Division 05 for shop-primed ferrous metal.
2. Division 09 for general field painting.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. Furnish information on characteristics of specified finish materials to ensure compatible primers.

B. If a potential incompatibility of primers applied by other trades exists, obtain the following from the primer applicator before proceeding further:

1. Confirmation of primer's suitability for expected service conditions.
2. Confirmation of primer's ability to be top coated with materials specified.

C. Notify Architect about anticipated problems before using the coatings specified over substrates primed under other Sections.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:

1. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

C. Coating types:

1. Shop primer: Zinc.
2. Intermediate coat: Epoxy.
3. Finish coat: Hybrid Urethane/Modified Siloxane.

1.4 SUBMITTALS

A. Data: The manufacturer Product Data for each coating system indicated, including primers.

1. Material list: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.

B. Manufacturer’s certification: Certifications that products supplied comply with requirements indicated that limit the amount of VOC in coating products.

C. Samples: Samples of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples defining each separate coat, including primers. Use representative colors when preparing Samples for review. Identify paint system on back of control Samples.
2. Resubmit until required sheen, color, and texture are achieved.
3. List of material and application for each coat of each sample. Label each sample for location and application.
4. Samples for each substrate for Architect review of color and texture: Provide two 12-inch square samples for each type of substrate with each type of finish.

D. Qualification data: For applicator to demonstrate its capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architect and owners, and other information specified.

E. Certification: Duplicate copies of manufacturer's affidavit with each shipment of materials delivered to the jobsite certifying that material furnished complies with specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer qualifications: Firm that specializes in producing high quality industrial coatings with a minimum of 10 years experience demonstrated by case histories in the designated field of application.

B. Applicator qualifications: Firm who has completed high-performance coating systems similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

C. Source limitations:

1. Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.
2. Only coatings that meet or exceed the performance of those identified herein may be submitted. No substitutions will be considered that change the generic chemistry of the coatings required by the Specifications.
3. Where manufacturer’s coating recommendations exceed those listed, the increased coating thickness shall be used. The coating thickness and coverage rate shall not be reduced from those scheduled.

D. SCAQMD Rule 1113: Submit paint manufacturer's certificate stating that provided coatings meet or exceed current SCAQMD Rule 1113 requirements.

E. Mockups: Provide a full-coat benchmark finish sample of each type of coating and substrate required.

1. Architect will select areas or surface to represent surfaces and conditions for application of each type of coating and substrate.
2. After permanent lighting and other environmental services have been activated in interior locations, apply coating systems to each surface as specified. Provide the required sheen, color, and texture of each surface.

    a. After finishes are accepted, Architect will use each surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.6 HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45-degree F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95-degree F.
B. Do not apply coatings in snow**,** rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5-degree F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

C. Protection:

1. Provide and maintain protection as required to protect finished work from damage until its acceptance.
2. Protect work of other trades, whether being coated or not, against damage from coating operation.
3. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protection.
4. Provide drop cloths, shields, barricades and other protection necessary to safeguard adjacent surfaces not to be painted. Post signs immediately after painting.

1.8 EXTRA MATERIALS

A. With closeout submittals, deliver one identified unopened gallon container of each color (if more than one color was used) of coating used on the Project. Identify with area and material for future identification.
B. Provide the Owner copy of instructions for touchup and maintenance recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tnemec Co. Inc. (basis of design).
B. Carboline Co.
C. Sherwin Williams; Industrial and Marine Coatings (SW).
D. Or equal.

2.2 COATINGS MATERIALS, GENERAL

A. General: Provide paint systems meeting or exceeding current SCAQMD Rule 1113 requirements.
B. Material compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another, and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
C. Material quality:

1. Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
2. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
3. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2.3 COLORS

A. Colors: Match Architect’s control samples.

2.4 COATING SYSTEM EXTERIOR EXPOSED UNPRIMED AND NON-GALVANIZED STEEL SURFACES (MT-3, MT-3B, MT-4 AND MT-5, see Elevations)

A. System Type: Aromatic Urethane, Zinc-Rich / Aliphatic Acrylic Polyurethane / Advanced Thermoset Solution Fluoropolymer
B. Surface Preparation: SSPC-SP6/NACE 3 Commercial Blast Cleaning with a minimum angular anchor profile of 1.5 mils.
C. Shop primer: Zinc-rich urethane primer/polyamidoamine epoxy/hybrid polyurethane, fast-cure, with 83 percent zinc content by weight in dried film.

1. Tnemec 90-97 Tneme-Zinc at 2.5 to 3.5 mils (65 to 90 microns) DFT.
2. Carboline: Carboline 621.
3. SW: Corothane 1 galvapac zinc primer.

D. Primer (Field Touch-Up): Aromatic Urethane, Zinc-Rich, with 83 percent zinc content by weight in dried film.

1. Tnemec Series 94 H2O Hydro-Zinc at 2.5 to 3.5 mils (65 to 90 microns) DFT.
2. Or equal.

E. Intermediate coat:

1. Tnemec Series 1095 Endura-Shield, 2 to 3 mils (50 – 75 microns) DFT.
2. Or equal.

F. Finish coat:

1. Tnemec Series 1078V at 3 to 5 mils (75 to 125 microns) DFT.
2. Or equal.

G. Gloss range: Semi-Gloss.
H. Quality assurance standards:

1. ASTM B 117: System shall pass 30,000 hours salt fog corrosion resistance.
2. ASTM G53: Finish shall pass with 100 percent gloss retention and no more than 4 MacAdam Units color change after 3,000 hours exposure.
3. ASTM D 3363: Finish coat hardness shall be HB or better.
4. ASTM D 4060: Finish coat shall pass no more than 50 mg loss after 1,000 hours with 1,000 g load.
5. AAMA 24604-98: Meet exterior weathering requirements of this document.

I. Finish shall be graffiti resistant.

2.5 COATING SYSTEM FOR INTERIOR UNPRIMED METAL SURFACES EXPOSED TO PUBLIC CONTACT

A. Applies to handrails and guardrails, hollow metal doors and frames, metal surfaces in toilet rooms and in maintenance storage areas, and in areas of similar conditions indicated.
B. Does not apply to interior exposed structural and miscellaneous steel. These will be painted under Section 09 90 00.
C. Surface preparation: SSPC-SP6 Commercial Blast Cleaning.
D. Shop primer: Zinc-rich Urethane Primer/Polyamide Epoxy Finish, Satin Finish.

1. Tnemec Series 69 Epoxoline at 4 to 6 mils (100-150 microns) DFT.
2. Carboline: Carboline 890.
3. SW: Tile Clad Plus B-62.

E. Finish coat:

1. Tnemec Series 69 Epoxoline at 4 to 6 mils (100 – 150 microns) DFT.
2. Carboline: Carboline 890.
3. SW: Tile Clad Plus B-62.

F. Total DFT: No less than 8 mils (200 microns) DFT
G. Quality assurance standards:

1. ASTM D 4541: Primer and complete coating system shall have adhesion strength of not less than 1000 psi.
2. ASTM D 3359: Primer and complete coating system shall have a rating of not less than 5.
3. ASTM D 3363: Finish coat hardness shall be 3H.
4. ASTM D 4060: Finish coat shall pass no more than 115 mg loss after 1,000 cycles with 1,000 g load.

2.6 COATING SYSTEM FOR GALVANIZED STEEL

A. Surface preparation:

1. SSPC-SP1 preparation to remove soluble contamination.
2. Thoroughly roughen the entire surface to be coated using compressed air nozzle brush-off blast cleaning with a fine abrasive to achieve a uniform anchor profile (1.5 to 2 mils) (38 to 50 microns).
3. Pressure wash with 140 to 150-degree F alkaline cleaner followed by tap water rinse is the preferred method to remove both water soluble and organic solvent soluble contaminants.

B. Touchup: Where the galvanized surface is damaged, repair shall consist of mechanical surface cleaning to bare metal, followed by touchup application of organic zinc-rich moisture cured urethane primer at 2.5 mils DFT minimum.
C. Spot primer: Surface tolerant epoxy primer/aliphatic acrylic polyurethane gloss finish.

1. Tnemec Series 90-97 Tnemec-zinc at 2.5 to 3.5 mils (65 – 90 microns) DFT
2. Carboline: Carboline 621.
3. Corathane 1 galvanized zinc primer.

D. Primer:

1. Tnemec: Series L69 Epoxoline.
2. Carboline: Carboline 890.
3. SW: Tile Clad Plus B-62.

E. Finish coat:

1. Tnemec Series 75UVX or Carboline “Carboxane 2000” at 2 to 3 mils (100-150 microns) DFT.
2. Gloss range: To be determined.

F. Total DFT: No less than 4 mils (200 microns) of field-applied coating.

G. Quality assurance standards:

1. ASTM D 3363: Finish coat hardness shall be HB or better.
2. ASTM D 4060: Finish coat shall pass no more than 95 mg loss after 1,000 hours with 1,000 g load.

2.7 COATING SYSTEM FOR ALUMINUM

A. Surface preparation:

1. Preparation: Thoroughly roughen the entire surface to be coated using compressed air nozzle brush-off blast cleaning with a fine, non-metallic abrasive to achieve a uniform anchor profile (1.5 to 2 mils) (38 to 50 microns).
2. System Type: Epoxy/Hybrid Urethane.

    a. Prime Coat: Tnemec L69 Epoxoline @ 2.0 to 4.0 mils DFT.
    b. Finish Coat: Tnemec 750 UVX @ 2.0 to 4.0 mils DFT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

B. Apply coatings only after unsatisfactory conditions are corrected and surfaces to receive coatings are thoroughly dry.

C. Correct unsatisfactory conditions before starting application.

3.2 PREPARATION

A. General:

1. Remove plates, machined surfaces, and similar items already in place that are not to be coated.
2. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
3. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning:

1. Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings.
2. Remove oil and grease before cleaning.
3. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Surface preparation: Clean and prepare surfaces to be coated according to manufacturer's instructions for each substrate condition, and as specified. Provide barrier coats over incompatible primers or remove primers and reprime substrate.

D. Material preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply coatings according to their manufacturer's instructions and the following.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

    a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.

    a. Omit primer on metal surfaces that have been shop primed and touchup painted.
    b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
    c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

C. Application procedures:

1. Brush, roller, spray, or other applicators according to manufacturer's requirements.
2. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.

D. Minimum coating thickness: Apply each material no thinner than manufacturers recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Prime coats:

1. Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
2. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

F. Completed work:

1. Match approved samples for colors, sheens, textures, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.
2. No “orange peel” finish, cloudiness, spotting, holidays, laps, sags, ropiness, drips, runs, skips or other surface imperfections, such as scratches, scrapes, dents, spots, stain, streaks and lines will be accepted.” “Remove, refinish, or recoat work that does not comply with the specified requirements.”

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:

1. Owner may engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency may perform appropriate tests for the following characteristics as required by Owner:

    a. Quantitative materials analysis.
    b. Absorption.
    c. Accelerated weathering.
    d. Accelerated yellowness.
    e. Color retention.
    f. Alkali and mildew resistance.
    g. Abrasion resistance.
    h. Apparent reflectivity.
    i. Washability.
    j. Dry opacity.
    k. Recoating.
    l. Skinning.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements.

    a. Contractor shall remove non-complying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials.
    b. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the 2 coatings are not compatible.

3.5 CLEANING

A. After completing coating application, clean spattered surfaces.
B. Remove spattered coatings by washing, scraping, or other methods.
C. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. At completion of construction activities of other trades, touchup and restore damaged or defaced coated surfaces.

END OF SECTION

DIVISION 10
SPECIALTIES

SECTION 10 10 00 – FIXED MARKERBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the installation of the fixed markerboards, the College will supply these to the Contractor.
   1. Fixed, Magnetic optically clear, ghost-free, dry –erase markerboards.

B. Related Items
   1. Construction Waste Management and Disposal- Section 01 74 19
   2. Rough carpentry, Section 06 10 00
   3. Concealed blocking, Sections 06 1000 and 09 25 00

1.2 SCOPE

A. Install Owner-furnished markerboards, provide direct-mounting adhesive kits, z-clip hardware, and anchors as necessary.

1.3 SUBMITTALS

A. The College will supply the required information for this section.

B. Product Data Manufacturer’s specifications and technical data by the College
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.

C. Shop Drawings (by the Contractor): Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage or mounting methods, hardware, and installation procedures, plus the following specific requirements.
   1. Indicated type of adhesive, backing, trim, or accessories required.
   2. Warranty documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. College will turn over the markerboards to the Contractor.

B. Storage and Protection Comply with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Markerboards
   1. Vivid Glass.
   2. Comparable products of other manufacturers.

2.2 FIXED MARKERBOARDS

A. Mounting:
   1. Provide manufacturers z-clip mounting system or manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify Conditions
   1. Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's recommendations.

B. Deliver factory pre-assembled units complete with frame and backer board.
1. If overall size prevents pre-assembly, prefit at factory and ship knocked down. Use concealed steel splines at all joints to maintain surface alignment.

C. Securely mount boards and trim in compliance with manufacturer's recommendations.
1. Provide grounds, clips, backing materials, adhesive brackets, anchors, trim, and accessories for complete installation.

D. Joints between adjacent boards shall be smooth, flush butt hairline seams.

3.3 CLEANING

A. Clean units in compliance with manufacturer's recommendations. Demonstrate proper maintenance and cleaning procedures to the Owner’s personnel. Provide at least one copy of the manufacturer’s published cleaning instructions and recommended schedule for each person trained.

END OF SECTION

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior signs: Building-mounted cast steel letters.
B. Interior Signs:

1. Cutout dimensional letters and logo.
2. Room and door signs.
3. Building identification signs.
4. Code-compliance signs at exits, stairs and toilet rooms.

1.02 COORDINATION

A. Furnish templates for placement of dimensional letters on metal support system at exterior locations.

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least quarter size.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
D. Samples:

1. Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment. Include the letters “B’ and “H” in cast steel letters with paint.
2. Dimensional Character:

   a. Two Dimensional Characters as selected by Architect: Full-size Sample of dimensional character. Letters can be used in final assembly upon approval.
   b. Exposed Accessories: Full-size Sample of each accessory type.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Verification Samples: Submit samples showing colors specified.
G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
B. Uniformity: For each sign form and graphic image process indicated furnish products of a single manufacturer.
C. Coordination: Before starting Shop Drawings, notify the Architect and arrange a meeting with the Owner's designated personnel to review in detail the work of this Section. Review and coordinate layouts for each sign, and obtain Architect's approval prior to manufacture.
D. All tactile room identification and exit signs shall include Grade 2 Braille translation with the tactile portion of the sign following the requirements of ADA.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Verify type of supporting construction; provide suitable attachments.
B. Adhesive as the sole means of installation is only allowed where sign is to be on glazing.
C. Interior signage:

1. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
2. Maintain this minimum temperature during and after installation of signs.

D. Exterior Dimensional signage: Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Signage shall conform to the CBC and specifically to the following CBC chapters:

1. Chapter 11B-201.1 for design and construction, 11B-603 and 11B-604.8 for passageways.

2. Chapter 11B-216.6 for scoping for signs where accessible routes diverge from the regular circulation path
3. Chapter 11B-703 for non-accessible existing entrances and general standards.
4. Chapter 11B-703.3 for braille requirements.
5. Chapter 11B-703.5.1, 6.2 and 7.3 for finish and contrast.
6. Chapter 11B-703.2.4 and 2.6 for proportions.
7. Chapter 11B-307.3 for pole-mounted objects, edges and corners.

B. Characters:

1. Comply with CBC 11B-703.5 for visual characters.
2. Character Type: Characters on signs shall be raised 1/32 inch minimum and shall be sans serif uppercase characters accompanied by contracted Grade 2 Braille (see Note 5 below).
3. Character Size: Raised characters shall be a minimum of 5/8 inch and a maximum of 2 inch high.
4. Finish and Contrast: Contrast between characters, symbols and their background must be 70% minimum and have a non-glare finish.
5. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10.
6. Letters measured must be uppercase. After choosing a typestyle to test, begin by printing the letters I, X, and O at 1 inch height. Place the template's 1:1 square over the X or O, whichever is narrower. If the character is not wider that 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is to narrow. If all the tests are passed, the typestyle is complaint with proportion code.

C. Braille Symbols:

1. Comply with CBC Section 11B-703.3.
2. Contracted Grade 2 Braille shall be used whenever Braille is required in other portions of these standards. Dots shall be spaced 1/10 inch on center in each cell, with 2/10 inch space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch above background
3. Provide rounded or domed Contracted Grade 2 Braille dots, each distinct and separate. Dots with straight sides and flat tops are not acceptable.

D. Type Imagery:

1. Type style: Sans Serif upper case.
    a. Letter Size: See signage drawings.
    b. Number Size: See signage drawings.
    c. Raised Letters: Letters shall be raised a minimum of 1/32 inch above background.
    d. Other Sizes: As specifically indicated.

2. Arrangement: Use standard spacing between letters, words, numbers and lines; center text.
3. Symbol Style: Recognized standard International Symbols of Accessibility, such as those developed by the American Institute of Graphics, for the U. S. Department of Transportation.
    a. Accessible Restrooms shall include a 6 inch high wheelchair logo. Logo shall be raised a minimum of 1/32 inch above the background.

b. On visual signs, characters and symbols shall be sized according – to view distance. Signs mounted 80 inch or more AFF shall have minimum 3 inch high characters.
c. Pictographs and ISA's (International Symbol of Accessibility) on interior signs at eye level, shall be minimum 3 inch high or twice as high as the height of text on the sign; whichever is greater. On signs where bottom is 72 inch or more AFF, minimum height shall be 6 inch or twice as high as the largest text on the signs; whichever is greater.

4. Colors:

a. Background Colors: As selected by the Architect from manufacturer's standard color range (12 colors maximum); one color maximum, typically.
b. Type Imagery: White or black, as selected by Architect to contrast with background colors; one color maximum, each, for interiors and exteriors.
c. Code Required Colors for Symbols and Signs: Where colors are mandated by Codes or Regulations conform to their requirements including 11B-703; colors from the CBC.
d. Other colors: Certain colors are specifically noted.

2.02 MANUFACTURERS

A. Acceptable Manufacturers:

1. Advance Corporation; Braille-Tac Division.
2. ASI.
3. Architectural Graphics, Inc.
4. Architectural Signs and Directories.
5. Vomar Products, Inc.
6. Or equal.

2.03 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADAAG and CBC Chapter 11B and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. All Signage Types: Unless otherwise indicated:

1. Character Font: Helvetica, or other sans serif font acceptable to the Architect.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

C. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide “tactile" signage, see above.
3. Braille shall be rounded or contracted domed top.
4. Character Height: 1 inch.
5. Sign Height: 2 inches, unless otherwise indicated.
6. Office Doors: Identify with room numbers to be determined later, not the numbers shown on the drawings.
7. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers shown on the drawings.
8. Service Rooms: Identify with the room names and numbers shown on the drawings.

2.04 DIMENSIONAL CHARACTERS

A. Fabricated characters and steel logo located on exterior walls: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASI Sign Systems, Inc.
b. Century Sign Builders
c. Gemini Incorporated.
d. Metallic Arts.
e. Or equal.

2. Character Material: Fabricated as indicated on Drawings.
3. Character Height: As indicated on Drawings.
4. Thickness: As indicated on Drawings.
5. Finishes: Powder coat.
6. Mounting: As indicated on Drawings.
7. Typeface: As selected by Architect.

2.05 PLASTIC SIGN MATERIAL

A. Material:

1. Type: Phenolic Resin Core with a three-ply melamine resin surface.
2. Thickness: 1/8 inch.

B. Adhesive: Pressure sensitive, hi-tack transfer tape with peel-back paper backing. Structural grade silicone adhesive for mounting on glazing.
C. Mounting Screws: Non-corrosive, tamperproof screws. Match finishes to the door hardware for the door where the signs are mounted.
D. Signs shall be non-static, fire retardant, and self-extinguishing.
E. No. SP125 Manufacturing Specifications per basis of design manufacturer:

1. Material thickness: 1/8 inch.
2. Standard sheet size: 48 inch x 96 inch.
3. Weight: 1/8 inch = 1 lb/ square foot.
4. Maximum continuous operating temperature: 225°F.
5. Flexural strength flat: 21,497 psi.
6. Tensile strength: 22,000 psi.
7. Shear strength: 22,729 psi.
8. NEMA rated "self-extinguishing"

2.06 SIGN TYPES

A. Graphic Process and Fabrication: All signs shall be manufactured using "Sand-Etched Process" or equivalent system, as per acceptable manufacturers stated methods, whereby characters are integral part of signage body.

1. Tactile characters shall be raised the required 1/32 inch from sign face. Glue-on letters, images and/or symbols are not acceptable.
2. Work to have sharp clean profiles.
3. Text shall be accompanied by Contracted Grade 2 Braille. Braille shall be separated 1/2 inch from corresponding raised characters or symbols.

4. Perimeter borders shall be 1/4 inch minimum.
5. Edges: Finish edges smooth and clean, without chips or burrs.
6. Corners: Provide radius corners; 1/8 inch diameter.
7. Cut-outs For Hardware: Factory made, accurately, to templates.
8. Mounting Holes: Factory drilled.
9. Adhesive Backing: Completely cover rear surface of each sign.

B. Room Identification Signs:

1. Refer to Drawings for names, numbers, identification symbols, sizes, configurations, and locations.
2. Colors for Type Imagery:
   a. Room Name Signs:
      1) Type: Black or white, to be selected by Architect.
      2) Background: One color to be selected by the Architect from manufacturer's standard color range (12 colors, minimum) for interior signs, unless otherwise noted. Refer to signage schedule.
   b. Room Number Signs:
      1) Type: Black or white, to be selected by Architect.
      2) Background: One color to be selected by the Architect from manufacturer's standard color range (12 colors, minimum) for interior signs, unless otherwise noted. Refer to signage schedule.
      3) Architect shall select a second color for signs located on exterior.

C. Accessibility Symbol Signs:

1. Refer to Drawings for identification symbols, sizes, configuration, and locations.
2. Figure Symbols for Building Entrance Signs:
   a. Size: 6 inch x 6 inch, typically.
   b. Refer to Drawings.
3. Geometric Symbols for Toilet Rooms:
   a. For Men/Boys: An equilateral triangle, 10 inches on a side; 1/4 inch thick.
   b. For Women/Girls: A 12-inch diameter circle; 1/4 inch thick.
   c. For Both Sexes: An equilateral triangle, 10 inches on a side, inlayed in 12 inch diameter circle; 1/4 inch thickness for the triangle and the circle.
4. Directional Signs.
5. International Symbol for Access for the hearing impaired.
6. Colors for Symbols:
   a. International Accessibility Symbols:
      1) Symbols: White.
      2) Background: Blue, Color No. 15090 per Federal Standard 595C.
   b. Male and Female Symbols:
      1) Symbols: Blue, color number 15090 per Federal Standard 595C.
      2) Background: White.

D. Room Capacity Signs:

1. Wording for sign at Assembly Room at Multi-Purpose Building: See Plans and Signage drawings. Number to be on Drawings or provided by Architect.
2. Refer to Drawings for identification.

2.07 ACCESSORIES

A. Interior:

1. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
   a. Exterior: Stainless steel, galvanized steel.
   b. Interior: Bright finish.
2. Tape Adhesive: Double sided tape, permanent adhesive.
   a. Completely cover the plate with adhesive.
3. Where flat signs are mounted on glass walls:
   a. Provide an additional blank plate with same background color.
   b. Mount this plate on the inside of glass in alignment with sign plate.

B. Exterior:

1. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   a. Use concealed fasteners and anchors unless indicated to be exposed.
   b. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   c. Sign Mounting Fasteners:
      1) Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      2) Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      3) Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

2.08 FABRICATION-DIMENSIONAL CHARACTERS

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

A. Layout: Accurately lay out work to maintain proper lines, levels and spacing.

3.03 INSTALLATION

A. Install in accordance with Drawings, manufacturer's instructions and CBC Chapter 11B.
B. Install neatly, with horizontal edges level.
C. Mounting location shall be determined so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of the door. CBC Section 11B-703.4.2.
D. Mounting:

1. See drawings for locations.
2. Press tape firmly to mounting surface, and secure each plaque or sign with minimum four tamper-proof screws for square or rectangular signs; minimum three tamper-proof screws for triangle, or round signs.
3. Signs shall have pre-drilled holes when delivered, and mounted with non-corroding anchors and tamper-proof screws.
4. When mounting on glazing, press silicone adhesive firmly to glazing. Clean excess adhesive from glazing.

E. Protect from damage until Substantial Completion; repair or replace damage items.

3.04 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
B. Remove temporary protective coverings and strippable films as signs are installed.
C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by District.

END OF SECTION

11B-703.1.1.2 Inspection. *Signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.*

SECTION 10 21 13 - TOILET COMPARTMENTS & SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Floor-mounted, overhead-braced painted metal toilet compartments.
2. Wall-mounted painted metal urinal screens.

B. Related requirements: Division 10 for toilet room accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate installation of toilet partitions and screens with their supports. Supply Shop or setting drawings, templates and directions for installing backing plates, brackets, anchors, suspension system, and other accessories.
2. Coordinate fabrication of toilet partitions for installation of surface-mounted and recessed toilet room accessories supported by the partitions. Obtain Shop or setting drawings, templates and directions required for reinforcement to be built-in the partitions.
3. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Scheduling and sequencing:
C. Pre-installation meeting:

1.3 SUBMITTALS

A. Data: Manufacturer Product Data for compartments and screens.
B. Shop drawings:

1. Show layout of compartments and screens in each space to receive them.
2. Show elevations.
3. Show fabrication and erection of compartment assemblies, to extent not fully described by manufacturer’s data sheets.
4. Show anchorage, accessory items and finishes.
5. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.

C. Samples: 6-inch square by 22-gage steel samples with the selected finish.

1.4 MAINTENANCE

A. With closeout submittal, provide instructions for proper care of compartments and screens such as required lubrications, adjustments, and cleaning.

PART 2 - PRODUCTS

2.1 MANUFACTURE/TYPE

A. One of the following, or equal:

MANUFACTURER	COMPARTMENTS	SCREENS
American Sanitary Partition Corp.	Type FF	Type 3
Flush Metal Corp.	Flushart H/B	WH-G
General/Partitions Mfg. Corp.	40 Series H/B	WHF-1
Shanahan's Manufacturing	OB Model	WH
Metpar	Corinthian	Type T

2.2 MATERIALS

A. Face plates:

1. Stretcher-leveled, cold-rolled steel with minimum zinc coating of 0.015-inch on each side; ASTM A 164 Type RS, mill-phosphatized.
2. Metal thicknesses:

   a. Doors: 22-gage.
   b. Partitions and screens: 20-gage.
   c. Stiles or pilasters: 16-gage.
   d. Door and partition edge locking strips: 20-gage.
   e. Stile or pilaster edge locking strips: 18-gage.

B. Stile or pilaster shoe base: AISI Type 302 or 304 stainless steel, 20-gage minimum.
C. Reinforcement:

1. For tapping: 14-gage.
2. For anchoring: 12-gage.

D. Sound-deadening core: Manufacturer's standard consisting of Kraft paper honeycomb, fiberboard or corrugated paperboard.
E. Minimum section thicknesses:

1. Doors and partitions: One inch.
2. Pilasters and stiles: 1-1/4-inch.
3. Urinal screens: One inch.

F. Hardware:

1. General: Stainless steel, chrome-plated brass, chrome-plated zinc alloy, and polished aluminum brackets, hardware and fasteners.
2. Brackets: Continuous (full height) stainless steel brackets.
3. Accessible compartments doors to be self-closing and have pulls on both sides.

G. Hinges: 54-inch 16-gage stainless steel continuous cam hinge.
H. Headrail: Extruded 6463-T5 alloy aluminum with anti-grip design.

I. Headrail brackets: 20-gage stainless steel with satin finish.
J. Latches: Mounted within door with combination keeper and bumper mounted on opposite pilaster. Latch shall be installed on both sides of accessible compartment doors and shall comply with CBC 11B-404.2.7.
K. Coat hook/bumper: Combination coat hook/bumper mounted on the water closet side of each compartment door.
L. Fasteners: Theft-resistant (one-way) fasteners for attachment of exposed hardware, component connections and compartments to walls; finished to match the hardware and fittings.

2.3 FABRICATION

A. Fabricate components straight, clean cut and free from defective workmanship and materials.
B. Assemble doors, panels and pilasters from 2 face sheets with integrally interlocked edges, or form edges by assembling and cementing under pressure to core; bind formed edges with lock strips.
C. Miter corners of edge moldings, weld and grind smooth and flush with adjacent surfaces.
D. Provide concealed reinforcement for tapping, or rivet nuts where machine screws are required for fastening.
E. Provide cutouts and reinforcement in toilet compartments as required for installation of accessories specified in Section 10 28 00. Make cut-outs plumb, level, and square; verify size of accessories before making cutouts so that the accessory flanges will conceal raw edges.
F. Finishing exposed ferrous surfaces to be painted, and hardware installed in doors before finishing:

    1. Clean galvanized steel surfaces after fabrication and before application of enamel coating system, to remove processing compounds, oils, and other contaminants.
    2. Prime metal with baked-on rust inhibitive primer.
    3. Apply 2 coats of thermosetting enamel finish of the color(s) selected by the Architect, applied by electrostatic process, and baked in compliance with paint manufacturer's instructions.
    4. As an alternate, powder-coating may be used for coating steel surfaces provided results are satisfactory to the Architect.

G. Finish on exposed hardware and fittings: US 26 polished chrome (complying with ASTM B 456, Type SC2), or AISI No. 8 (mirror) finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Set compartments and screens plumb, level, and space uniformly in compliance with their manufacturer's instructions and the following.
B. Set pilasters with anchorages having not less than 2-inch penetration into structural floor, unless otherwise recommended by partition manufacturer.

    1. Level, plumb, and tighten installation with devices furnished.

2. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

C. Secure panels to walls with continuous brackets not less than 2 stirrup brackets attached near top and bottom of panel.

1. Locate wall brackets at the same height, so that holes for wall anchorages occur in tile joints.
2. Secure panels to pilasters with not less than 2 stirrup brackets located to align with stirrup brackets at wall.
3. Anchor panels to studs or backing plates; fastening components to walls with toggle bolts will not be allowed.

D. Install hardware as recommended by manufacturer. Conceal evidence of drilling in finished work.

E. Tolerances: Installed compartments and screens shall be within the following tolerances.

1. From true position: 1/4-inch.
2. From plumb, alignment, and level: 1/8-inch.

3.3 ADJUSTING/CLEANING

A. Adjust brackets and hardware to provide uniform clearances not exceeding the following dimensions:

1. Pilasters and walls: One inch.
2. Panels and walls: One inch.
3. Pilasters and panels: 1/2-inch.
4. Pilasters and doors: 3/16-inch.

B. Adjust hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30-degree from closed position when unlatched, except set hinges on accessible compartment doors to be self-closing.

C. After completion of installation, clean and polish exposed surfaces and touchup minor scratches. Remove and replace components that cannot be satisfactorily touched-up in the field, in the Architect's opinion.

END OF SECTION

SECTION 10 26 13 - CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stainless steel corner guards.
B. Related requirements: Division 09 for concealed wall supports for attachment of corner guards.

1.2 SUBMITTALS

A. Data: Manufacturer product data including physical dimensions, mounted measurements, and anchorage details for the corner guards.
B. Shop Drawings: Provide floor plan showing locations for corner guards.
C. Samples: 24 inches long of the design, configuration and finish proposed for the Project.

1.3 HANDLING

A. Cover stainless steel components, after fabrication, with electrostatically applied plastic film.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Model CO-8 by Construction Specialties, Inc., basis of design.
B. Or equal.

2.2 MATERIALS AND CONSTRUCTION

A. Corner guards: Length indicated, 14-gage Type 430 satin (NAAMM No. 4) finished stainless steel, provided with factory applied adhesive for concealed mounting.
B. Corner radius 3/16-inch.
C. Fasteners: Self-drilling steel screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Install corner guards in accordance with their manufacturer's instructions, plumb, secured rigidly in position to wall framing members only.
B. Space fasteners within 2 inches of ends and at 12 inches o.c. maximum, equally and symmetrically spaced thereafter.

3.3 FIELD QUALITY CONTROL

A. After completing installation, remove protective film and clean exposed surfaces. Touchup minor scratches.
B. Remove and replace components that cannot be satisfactorily touched-up in the field.

END OF SECTION

SECTION 10 28 00 – TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes toilet accessories, including framed mirrors.
B. Related requirements:

1. Divisions 09 and 10 for cutouts, openings and recesses for installation of accessories.
2. Divisions 05, 09 and 10 for toilet room accessories supports.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Pre-installation meeting:

1.3 SUBMITTALS

A. Data: Manufacturer Product Data, and illustrations, complete parts list, and installation requirements for each accessory specified.
B. Samples: Full size Samples of accessories, when requested. Samples will be returned to the Contractor.
C. Schedule: Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for the Project.

1.4 QUALITY ASSURANCE

A. Basis of design is for accessories made by Bobrick Washroom Equipment, Inc. Other acceptable manufacturers include American Specialties, Inc. and Bradley Corp.
B. Compliance with CBC requirements for accessibility for accessories and their attachments is the Contractor's responsibility.

1.5 HANDLING

A. When possible, keep protective covers on accessories until their installation is complete, then remove at final cleanup.

1.6 SPECIAL WARRANTY

A. Provide the Owner the manufacturer warranty protecting mirrors against silver spoilage for 5 years after Substantial Completion.

1.7 MAINTENANCE

A. Furnish operating instructions and keys for equipment locks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS & MODELS

A. Basis of design: Bobrick, or as indicated in the schedule below on the Drawings, or by ASI Group.
B. Or equal.

2.2 MATERIALS

A. Stainless steel: AAMA Type 302/304 complying with ASTM A 167.
B. Sheet steel:

1. Cold-rolled commercial quality, complying with ASTM A 336, 20 gage minimum.
2. Galvanized steel: ASTM A 653 LQ, G60 zinc coating, 20 gage minimum.

C. Mirror glass: 1/4-inch (6 mm) thick, "Silvering Quality" float glass with silver coating, copper protective coating and 2-mil thick protective paint; complying with CS 27.
D. Mounting devices: Galvanized steel.
E. Fasteners: Spanner head design stainless steel fasteners where exposed; may be galvanized steel where concealed.

2.3 FABRICATION

A. Fabricate units with seamless one piece flanges on exposed faces.

1. Miter corners, weld and grind smooth and flush with parent metal so that welds are invisible on exposed surfaces.
2. Open joints (not fully welded) on exposed surfaces are not acceptable.
3. Conceal anchoring devices.

B. Hang doors or panels on continuous stainless steel piano hinges.
C. Master-key locked dispensing units. Key coin boxes of coin-operated dispensing units separately from the lock on the unit.
D. Grind edges smooth, both inside and out.
E. Finish exposed surfaces with an AISI No. 4 finish running in the same direction (horizontal or vertical) for all accessories, except where a knurled surface is specified for grab bars.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that attachment surfaces are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Drill holes to correct size and location. Install accessories plumb, level and equally spaced (where applicable).

1. Where accessories are attached to toilet compartments, do not “thru-bolt” but drill and tap partition reinforcement
2. Provide templates of accessories for drilling and tapping required in Section 10 21 13.

B. When installed in ceramic tile surfaces, coordinate accessory location with the tilework so that the top and one side (closest to the door) of the accessory will align with a tile joint.
C. Attach accessories plumb, level, evenly spaced where applicable, securely anchored with screws or bolts to steel studs or backing plates. Do not use Molly or toggle bolts in gypsum board.
D. Install grab bars to withstand a downward load of at least 250 lbf when tested according to method in ASTM F 446.

E. Adjust accessories for proper operation. After completion of installation, clean and polish exposed surfaces after removal of protective coverings.

3.3 ACCESSORY SCHEDULE

1. To be determined.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Mounting brackets.
4. Fire extinguisher locators.

B. Related requirements: Division 21 for fixed fire protection systems.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting:

1. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
2. Coordinate sizes and locations of fire extinguisher cabinets with wall depths. Final location of fire extinguisher cabinets is subject to the Fire Department’s approval.
   a. Verify cabinet locations with both the Fire Department and the Architect and Owner’s Authorized Representative during the framing stage of the Project.
   b. Positioning of cabinets at locations other than indicated shall be done at no additional cost to the Owner.
   c. Where extinguisher Locations are not indicated, assume cabinet and extinguishers will be located within 75 feet of any point in the building, or at a rate of one for each 3,000 square feet of building area, or portion thereof, whichever yields the greater number of extinguishers.

1.3 SUBMITTALS

A. Data: Manufacturer Product Data and installation instructions for the work of this Section.

1. For fire extinguishers, submit Drawings indicating locations and type of extinguishers after approval by Fire Marshall.
2. For extinguisher cabinets, include roughing-in dimensions and details showing mounting methods, door hardware, cabinet type and materials, trim style and door construction, and materials.
3. Include color charts showing full range of manufacturer standard colors and designs available.

B. Closeout: 2 keys for each cabinet, all keyed alike, and properly tagged.

1.4 QUALITY ASSURANCE

A. Uniformity: Provide all fire extinguishers, cabinets and accessories made by one manufacturer.
B. UL listing: Provide UL listed fire extinguishers bearing the UL "Listing Mark" for type, rating, and classification specified. Provide cabinets with the same fire-rating as walls in which they are installed.

C. NFPA compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

1.5 SPECIAL WARRANTY

A. Fire extinguisher warranty:

1. Warranty stating that manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship for 5 years from Substantial Completion.
2. Failures include:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Products by Larsen's Manufacturing Co.
B. Other acceptable manufacturers:

1. JL Industries, Inc./Division of Activar Construction Products Group.
2. Potter Roemer LLC.
3. Or equal.

2.2 FIRE EXTINGUISHERS

A. Multi-purpose dry chemical: 3A:40B:C UL rated, 6 lb. capacity, aluminum valve.

1. Markings:
2. Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
3. Label with standard warnings concerning breathing, eyes, skin and ingestion. Provide emergency and first aid procedures.

2.3 FIRE EXTINGUISHER CABINETS

A. Basis-of-design-product: "Architectural Series" Steel "Tub" box, "Larsen Loc", semi-recessed, with solid, lockable door.
B. Construction: Manufacturer standard enameled steel box. Miter and weld perimeter door and frames and grind smooth.
C. Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend). Miter and weld all joints.
D. Door hardware: Manufacturer standard door operating hardware and keyed lock. Provide concealed or continuous type hinge permitting door to open 180 degrees.
E. Factory-finishing:

1. After cleaning and pretreatment, apply manufacturer's baked enamel coating of the color selected by the Architect from manufacturer's palette.
2. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk-screen process.
3. Provide vertical lettering on door as selected by Architect from manufacturer's standard letter sizes, styles and layouts.

2.4 ACCESSORIES

A. Fire extinguisher locators: White plastic. Red edge in white vinyl with a fire extinguisher symbol and “Fire Extinguisher” lettering by Flynn, or equal.
B. Mounting brackets (wall hooks):

1. Basis-of-design-products: Larsen’s Model B4, standard brackets of sizes required for extinguisher specified, in manufacturer standard plated finish.
2. Provide brackets for extinguishers, other than those in cabinets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
C. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Verify with Fire Marshal and Architect each fire extinguisher cabinet location during the framing stage of the Project; location of fire extinguisher cabinets is subject to the Fire Marshal's approval.

1. Position cabinets at locations other than indicated at no cost to the Owner.
2. Where not indicated locate, cabinets and extinguishers with the Architect's approval, so that they can be reached within 75 feet travel distance from any point, or one for each 3,000 square feet, whichever is more restrictive.

B. Install cabinets so that the fire and/or acoustical rating of the walls are not compromised.
C. Attach mounting brackets and fire extinguisher cabinets securely to studs or backing plates, square, plumb and level, in compliance with their manufacturer's instructions; do not attach them to gypsum board with Molly or toggle bolts.
D. Install fire extinguisher locators where indicated. Secure to supports with double-sided foam tape.

3.3 FIELD QUALITY CONTROL

A. Verify that installed extinguishers are fully charged and tagged in accordance with requirements of authorities having jurisdiction.
B. Touchup damaged finish, when the results are acceptable to the Architect, otherwise replace damaged components.

END OF SECTION

DIVISION 11
EQUIPMENT

THIS SECTION IS OWNER-FURNISHED, OWNER-SUPPLIED

SECTION 11 61 23 - DEMOUNTABLE PLATFORMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work in this Section includes all labor, materials and equipment to furnish and install the following:

1. Assembly Room seating risers
2. Music Room rehearsal risers

B. Related sections include the following:

1. Finished stage floor
2. Stacking audience seating

1.3 SUBMITTALS

A. Submit shop drawings for fabrication and installation. Include plans, detail sections, and related conditions. Indicate materials, methods, finishes, attachments, and accessory items.

B. Shop drawings shall reflect field survey information.

C. Submit load data for the platform system, including safe working loads, proof loads, and any special conditions relating to the use of the platform system.

D. Upon completion of the installation, provide 1 reduced set of the shop drawings in a 3-ring binder for the Owner. In addition, provide electronic copies of the shop drawings for the Owner, the Architect and the Theatre Consultant. Electronic copies shall be in PDF format.

E. Provide 1 hard copy of an instruction and maintenance manual for the Owner. In addition, provide electronic copies of the manual for the Owner, the Architect and the Theatre Consultant. Electronic copies shall be in PDF format. The manual shall include:

1. System description.
2. Operation instructions, including safety measures.
3. Maintenance instructions, including recommended procedures and schedules for inspecting system components.
4. Catalog cuts for all purchased equipment

F. Instruction and maintenance manuals shall be provided at the time of Owner training.

1.4 WARRANTY

A. Warrant the equipment in this contract to be free of defects in materials and workmanship for a period of 2 years after acceptance of the completed installation by the Owner. Defective work shall be repaired and replaced at no cost to the Owner. The Warranty shall not cover the results of normal use, nor shall it cover damage due to neglect or improper use of the equipment.

1.5 APPLICABLE STANDARDS

A. Aluminum Association:

1. AA Standard AA-M12C22A41.
2. AA Standard AA-M12C22A42/44.

B. American Institute of Steel Construction: AISC Manual of Steel Construction

C. American Plywood Association: US. Product Standard PS 1-83

D. American Society for Testing and Materials

1. ASTM A36: Standard Specification for Structural Steel.
2. ASTM A283: Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
3. ASTM A307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
4. ASTM A325: Standard Specification for High-Strength Bolts for Structural Steel Joints.
5. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. ASTM A501: Standard Specifications for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
7. ASTM A570: Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
8. ASTM B209: Standard Specification for Aluminum-Alloy Sheet and Plate.

E. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code-Steel.
2. AWS D1.3 Structural Welding Code-Sheet Steel, Second Edition.

F. National Fire Protection Association (NFPA): NFPA 102: Standard for Assembly Seating, Tents, and Membrane Structures.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Equipment shall be by one of the following:

1. Staging Concepts
   7008 Northland Dr. North Suite 150
   Brooklyn Park, Minnesota 55428
   (763)533-2094
2. StageRight Corporation
   495 Pioneer Parkway
   Clare, Michigan 48617
   (989) 386-7393
3. Wenger Corporation
   555 Park Drive
   Owatonna Minnesota 55060
   (507) 455-4100

2.2 FINISHES

A. Metal parts shall be free from rust, scale, dirt, and welding spatter. All weldments or other metal components shall receive a coat of corrosion resistant primer prior to finish coating and component assembly.

B. Steel finish coat shall be flat black alkyd enamel, except where noted otherwise in the Contract Documents.

C. Aluminum finish coat shall be black anodized except where noted otherwise in the Contract Documents.

2.3 PLATFORM DETAILS

A. Platforms shall support a minimum live load of 150 pounds per square foot.

B. Platforms shall have integral locks for attaching adjacent sections.

C. Platform edging shall be extruded aluminum designed to accept accessory components.

1. Edging finish for Assembly platforms shall be black anodized.
2. Edging finish for Music Room platforms shall be mill finish.

D. Support legs shall permit 2 inch fine-leveling adjustment with a non-marring screw foot.

E. Bridge supports are acceptable, if applicable to a manufacturers' system.

F. Floor surface shall be:

1. Plyron painted black for Assembly platforms.
2. Commercial grade carpet for Music Room. Color to be selected by Architect.

2.4 SEATING RISERS

A. Provide decks, supports, steps, closure panels, chair stops, guardrails, aisle lights, and related components as required to achieve the riser configurations shown on the drawings.

B. Design guardrails, posts, and their anchorage to withstand the following horizontal forces applied separately:

1. 200 pounds applied at any point and in any direction along the top rail.
2. 50 pounds per foot acting outward and/or inward at top rail.
3. Intermediate rails, panel fillers and their connections shall be capable of withstanding a load of 25 pounds per square foot applied horizontally at right angles over the entire tributary area, including openings and spaces between rails.

C. Hand rails and guardrails shall be the manufacturer's standard.

D. In addition to the riser dead loads, the riser structure shall of support a minimum live load of 125 pounds per square foot. Lateral bracing shall be provided to support 3 percent of the total superimposed live load. Risers shall have lateral sway bracing loads of 24 pounds per foot parallel and 10 pounds per foot perpendicular to the seat.

E. Provide UL approved, low voltage aisle lights, with associated transformers and wiring. Aisle lights shall plug in a standard convenience outlet. Aisle lights shall be movable along the platform, to permit different aisle configurations. Where there are intermediate steps, provide lights on both the platforms and the steps.

2.5 STORAGE DOLLIES

A. Provide castered dollies capable of storing the entire Assembly seating riser system including decks, railings, steps, closure panels, and all associated accessories and hardware. Deck storage dollies shall accommodate 15 deck sections, secured with ratchet straps.

B. Deck storage dollies shall also include heavy duty push/pull bars, welded to the dolly frame.

PART 3 – EXECUTION

3.1 COORDINATION

A. The Contractor is responsible for reviewing all drawings, specifications, and field conditions which affect the work in this contract. Notify the Owner whenever field measurements, analysis of the drawings and specifications, or progress of other trades indicates that the work in this contract cannot be completed as specified or as scheduled.

3.2 JOB CONDITIONS

A. The Contractor shall visit the site and verify all dimensions and existing conditions. The Contractor shall also be familiar with the work of adjoining trades and coordinate with their work.

B. The Contractor is ultimately responsible for the equipment fitting the intended spaces without interference.

3.3 PROTECTION OF EQUIPMENT

A. Protect the equipment in this Section from damage and deterioration, including rust, during all phases of the work, from the time of manufacture to installation.

3.4 CLEANING AND REPAIR

A. Repair any work or finishes that are damaged during installation by the Contractor for the work in this Section. This includes the work in this contract and the work of others. Where the work of others is damaged, reimburse the appropriate con tractor for the repair.

3.5 COMMISSIONING AND PUNCHLISTING

A. The Contractor shall work with the General Contractor or Construction Manager to arrange for a punchlisting period for the work in this Section. Punchlisting shall consist of a minimum of one 8-hour day. The building schedule shall be such that no other conflicting or obstructing activity is taking place.

B. During the punchlisting period, seating risers shall be deployed in each unique configuration. The Contractor shall provide labor as required.

C. Prior to punchlisting, the Contractor shall commission the system and certify that the installation is complete and ready for punchlisting by the Theatre Consultant. If substantial portions of the installation are not complete, requiring the Consultant to make another punchlist trip, the Contractor shall compensate the Consultant for time spent and travel expenses. Compensation shall be at the Consultant’s prevailing hourly and per diem rates.

3.6 TRAINING

A. Deployment of the seating risers described above for punchlisting shall also serve as the Owner training session.

END OF SECTION

SECTION 11 61 33 - RIGGING SYSTEMS AND DRAPERIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work of this Section includes all labor, materials, equipment and services necessary to complete the Stage Rigging and Draperies installation, as shown on the drawings and specified herein, including, but not limited to, the following:

1. Pipe grid
2. Black masking
3. Cyclorama
4. Tracked, manually-drawn variable acoustics curtains
5. Additional support structures as required to meet the intent of the Contract Documents

B. Related sections include the following:

1. Support steel.
2. Finishes
3. Performance Lighting Systems
4. Common Work Results for Electrical
5. Interior Lighting Fixtures
6. Commissioning of Electrical Systems
7. Sound, Video and Communication Systems
8. Mechanical system.
9. Fire protection system.

1.3 FULLY WORKING SYSTEMS

A. Review Drawings and Specifications that affect work in this Section.

B. Notify Architect upon indication that work in this Section cannot be completed as specified or scheduled.

C. Provide additional parts or devices required for functional requirements of control systems at no extra cost to Owner.

1.4 DEFINITIONS

A. Furnish – supply equipment to the project for use or installation by others.

B. Install – install equipment provided to the project by others.

C. Provide – supply and install equipment.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Delegated design: The work of this Section requires deferred approval and delegates design to the Contractor. The work of this Section has not been engineered and is not fully detailed on the Drawings, which indicate desired profiles and design intent.

1. The Contractor is responsible for engineering, fabricating and installing the work to withstand loads and other criteria prescribed by the California Building Code (CBC), indicated, and specified, within the physical limitations indicated on the Drawings.

2. A California-licensed professional engineer employed by the Contractor (CEOR) shall prepare drawings and calculations for this work, and seal and sign same.

1.6 QUALITY ASSURANCE AND STANDARDS

A. References to code, standards, specifications, and recommendations of technical societies, trade organizations, and governmental agencies will refer to the latest edition of such publications adopted and published prior to bid submittal. All codes and standards will be considered a part of this specification as if they were fully included.

B. Work and materials shall comply with rules and recommendations of:

1. Prevailing national, state and local building codes.
2. American Iron and Steel Institute (AISI).
3. American National Standards Institute (ANSI).
4. American Society of Mechanical Engineers (ASME).
5. American Society for Testing and Materials (ASTM).
6. American Welding Society (AWS).
7. Entertainment Services and Technology Association (ESTA).
8. Industrial Fasteners Institute (IFI).
9. International Organization for Standardization (ISO).
10. National Association of Chain Manufacturers (NACM).
11. National Fire Protection Institute (NFPA).
12. Society of Automotive Engineers (SAE).

C. Minimum design factor for lifted loads: 8:1. Design factor shall include the effects of static loads, dynamic impact loads and reductions for end terminations and bending ratios.

D. Minimum design factor for static loads: 6:1

E. Maximum fleet angle: 1-1/2 degrees.

F. Cable bending ratio for manually operated systems shall be at least 30 times the diameter of the cable. Motorized systems shall comply with the wire rope manufacturer’s minimum recommended bending ratio.

G. Wire rope clips shall be drop-forged.

H. Fasteners typically shall have a minimum SAE J429 Grade 5 or ISO R898 Class 8.8 rating. Bolts in tension shall have nuts of equivalent rating. Fasteners shall be self-locking or secured by alternate means to prevent loosening.

I. Shackles and turnbuckle jaws shall be screw pin or bolt type, moused with plastic tie-wrap after installation. Round pins are not acceptable.

J. Turnbuckles shall be durably marked by the manufacturer with the name or trademark of the manufacturer, size or rated load, and grade for alloy eyebolts.

K. Shackle bodies shall have durable markings by the manufacturer to show the name or trademark of the manufacturer, size, and rated load.

L. Shackle pins shall have durable markings by the manufacturer to show the name or trademark of the manufacturer, and grade, material type, or load rating.

M. This specification sets forth minimum safety standards, operational criteria, and minimum standards for quality in workmanship. It is the sole responsibility of the Contractor to design, engineer, furnish and install a safe, fully functional system in compliance with the design intent of the Contract Documents.

1. Engineering responsibility:

    a. Engineer, fabricate, assemble and erect the work of this Section to meet or exceed the specified design and performance criteria, and to provide structurally sound, rigging assemblies conforming to governing codes and regulations.
    b. The assemblies shown on the Drawings and specified herein are intended to define design intent and minimum performance requirements. Do not change indicated profiles without the Architect's written consent.
    c. Fasteners and connections are shown schematically. A California-licensed civil or structural engineer employed by the Contractor shall determine final types and sizes.

        1) In no case shall the fasteners or connections conflict with or require revision of the finish profiles of the assemblies specified herein or the supporting work.
        2) Connections to the supports shall not impose eccentric loading or induce twisting or warping.
        3) Connections to the structural frame shall be able to accommodate misalignment of the steel structure within limits allowed by the AISC tolerances.

1.7 SUBMITTALS

A. Bid Submittals

1. Bill of materials: Identify parts by common industry standard numbers and descriptions.
2. Cut Sheets: Manufacturer’s catalog datasheets of all products listed in bill of materials.
3. Statement: Manufacturer agrees to warranty provisions.
4. Projected Timetable: List time in weeks for following activities:

    a. Shop drawing preparation
    b. Fabrication
    c. Shipping to site
    d. System commissioning
    e. As-built drawing preparation

B. Shop Drawings

1. Format: Uniform sheet size.
2. Binding: Bind shop drawings of more than five drawings.
3. Shop drawings relating to the pipe grid shall be stamped by a structural engineer licensed in the state of California.
4. Shop drawings shall include:

    a. Title sheet listing all sheets in the submittal.
    b. Scale plans and elevations.
    c. All information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation.
    d. Electrical specification, components, one-line riser, and interconnections.
    e. Country of origin for equipment

5. Review: Fabrication shall not commence until Theatre Consultant and Architect determine that the shop drawings are in compliance with design intent of Contract Documents.
6. Revisions: Resubmit as required.

C. Calculations

1. Prepare calculations in compliance with current design rules of the CBC. Include analysis for wind and dead load on framing members, anchors, and concrete inserts.

    a. Show section property computations for framing members. Show vertical and horizontal loads on building supports. Existing test reports will be an acceptable substitute for calculations. Calculations shall be signed and sealed by a California-licensed professional engineer.

D. Manuals

1. Format: Letter and/or tabloid size paper.
2. Binding: Standard 3-ring binder.
3. Electronic Format: PDF files on USB flash drive.
4. Manuals shall include:

    a. Contractor contact information
    b. Manufacturer contact information
    c. System description
    d. Operation instructions, including safety measures
    e. Maintenance instructions, including recommended procedures and schedules for inspecting system components
    f. Equipment design parameters including safe working loads and duty cycles.
    g. Parts and subassembly lists
    h. Spare parts list and source information
    i. Catalog cuts for all purchased equipment

E. As-Built Drawings

1. Format: Letter and/or tabloid size paper.
2. Binding: Standard 3-ring binder.
3. Electronic Format: PDF files on USB flash drive.
4. Delivery: Within one month of system acceptance.
5. As-built drawings shall include:

    a. Final shop drawings.
    b. Final bill of materials.

F. Test Report Submittals

1. Submit all required testing certificates prior to installation of associated equipment.

1.8 WARRANTY

A. Manufacturer shall warrant equipment as follows:

1. According to guarantee provisions in General Conditions.
2. For three years from acceptance of systems, provide services detailed below:

    a. Provide for the Owner’s operating staff a technical and operational assistance hotline advice service at no additional cost for the duration of the warranty period. Such advice to be available during normal working hours and on evenings and weekends.
    b. Provide all required maintenance or replacement within 30 days of notification by the Owner, with the following exception: All required maintenance or replacement which affects the safe operation of the installation shall be accomplished within 48 hours.

B. Warranty period: Commence upon final acceptance by Owner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE CONTRACTOR

1. H & H Specialties
   14850 Don Julian Road, Suite B
   City of Industry, CA 91746
   626.575.0776
2. LVH Entertainment Systems
   530 Los Angeles Avenue
   Suite #115-160
   Moorpark, CA 93021
   805.278.4584
3. Musson Theatrical
   890 Walsh Avenue
   Santa Clara, CA 95050
   408.986.0210

2.2 PIPE GRID

A. The pipe grid shall consist of 1-1/2-inch nominal diameter standard weight (Schedule 40) pipe connected with clamps. Paint pipes black.

B. Clamps shall be JR Clancy “Cross Grid Connectors”, or approved substitute. Provide a clamp at every pipe intersection. Clamps shall be black.

C. Pipe splices shall be made with an 18-inch-long, 1 - 9/16-inch diameter DOM tube with a minimum wall thickness of 3/16 inch. Fasten each side of the splice with two 3/8-inch bolts.

D. Design the hanger assemblies for the dead load of the pipe grid, plus a minimum live load of 30 pounds per linear foot with a 200 pound point load mid span, to a maximum anticipated total live load of 8,000 pounds.

E. Hangers penetrate a suspended acoustical ceiling. Coordinate installation sequencing as required.

2.3 SIGNAGE

A. Provide “Rigging Information” signs, as illustrated in the drawings. Locate as directed in the field by the Theatre Consultant.

B. Signs shall be dark blue lamicoid with gray engraving.

C. Provide one sign.

2.4 STAGE DRAPERY SCHEDULE

A. Stage drapery schedule is as follows:

1.

Description	Quantity	Height	Width
Legs	8	~17’-0"	8'-0"
Cyclorama	1	~17’-0"	24'-0"
Acoustic Curtains	2	~8'-6"	~10'-6"
Acoustic Curtains	11	~8’-6”	~8’-0”

B. Field verify all conditions and drapery dimensions after pipe grid and track are installed and level.

2.5 MASKING DRAPERIES

A. FABRICS

1. Legs and Acoustic Curtains: 25 ounce, 100% Trevira CS Polyester, inherently flame retardant velour, KM Fabrics' "Charisma", or approved equal. Color: black.
2. Cyclorama: 100% Trevira CS IFR Polyester, 5.90 ounce per square yard, seamless fabric. Color: bleached white.
3. Fabrics shall be flame treated if required in a manner approved by the appropriate local agency, where applicable. A notarized affidavit shall accompany the draperies attesting that all fabrics have been flame treated in the approved manner.
4. No pieced horizontal or split widths of fabric shall be incorporated in any part of any drapery.
5. Fabrics of 1 color shall be from 1 dye lot.
6. Velour nap shall run in a consistent direction. Nap shall run up for black velour masking pieces.

B. DRAPERY FABRICATION

1. Masking legs are sewn flat and are unlined.
2. Acoustic curtains shall be sewn with box pleats to 100% fullness.
3. Acoustic curtain panels shall overlap according to the manufacturer's overlap master carriers. Panel widths shall be sized such that panels cover the full length of the track while overlapping.
4. Reinforce the top of each piece with polyester webbing weighing a minimum of 2.8 ounces per yard, and double stitched at the top. Provide machine-set black anodized No. 3 grommets on 1-foot centers.
5. Provide 36-inch-long, cotton No. 4 tie lines on all pipe-mounted pieces. Tie lines shall be black, except for the one at centerline, which shall be white. If a tie line is not on center, the two symmetrical about center shall be white.
6. Provide each tracked piece with oblong spring, carabiner type snaps.
7. Hem the bottoms of the legs with a 6-inch-deep double turned hem with a separate canvas chain pocket approximately 3 inches above the bottom of the face fabric. Provide No. 8 zinc coated chain.
8. Hem the bottoms of the cyclorama with a 6-inch-deep double turned hemmed pipe pocket. Line the pocket with nylon fabric to prevent tearing. Furnish appropriate lengths of bottom pipe for each piece. Thread and cap both ends of each pipe. Provide couplers.
9. Sew back the face fabric of each piece 4 inches on both sides. The sides of each drapery piece shall hang plumb within 2 inches.
10. Label each piece at both bottom corners with the dimensions of the piece, the manufacturer, and the date of manufacture. Labels shall be permanently sewn.
11. Install the tracked curtains on traveler track specified below.

2.6 TRAVELER TRACK

A. Curtain track and related hardware shall be H&H Specialties Model 300 track for manual walk-along operation. Supply track lengths with the minimum possible number of splices. Color: black.

B. Master and single carriers shall have nylon-tired wheels. Carriers shall have swivel eyes, trim chains, and rubber spacers. Master carriers for adjacent curtains shall have an overlap arm. Provide carriers on 1-foot centers. Carriers shall be black.

C. Provide end stops as required.

D. Provide one positioning pole hook with telescoping extension handle.

2.7 DRAPERY STORAGE HAMPERS

A. Provide a quantity of hampers sufficient to store all masking legs and the cyclorama.

B. Storage hampers shall have plywood tops and caster “donuts”.

2.8 PORTABLE EQUIPMENT

A. Provide the following portable equipment for the Assembly Room:

1. Description: 1.5” I.D. (1.9” O.D.) Pipe
   Type: Schedule 40
   Dimension: (8) at 8’-0”
   (2) at 12’-0”
   Finish: Matte Black

2. Description: Swivel Cheeseboroughs
   Dimension: 1-1/2”
   Finish: Black
   Quantity: 20

PART 3 – EXECUTION

3.1 COORDINATION

A. The Contractor is responsible for reviewing all drawings, specifications, and field conditions which affect the work in this Section. Notify the Architect whenever field measurements, analysis of the drawings and specifications, or progress of other trades indicates that the work in this Section cannot be completed as specified or as scheduled.

B. Within 6 weeks of the award of contract, and prior to the preparation of shop drawings, the Stage Rigging Contractor shall submit a written review of related work as it appears on the Contract Documents. The review shall identify errors, omissions or obstructions related to the installation and operation of the equipment in this Section. The sole intent of this written review is to identify potential problems as soon as possible. It is understood that some errors, omissions or obstructions may not be evident until the Rigging Contractor prepares shop drawings.

3.2 JOB CONDITIONS

A. The Contractor shall visit the site and verify all dimensions and existing conditions. The Contractor shall also be familiar with the work of adjoining trades and coordinate with their work.

B. The Contractor is ultimately responsible for the equipment fitting the intended spaces without interference.

3.3 INSTALLATION

A. Only trained personnel shall install the equipment in this Section.

B. Provide scaffolding and platforms as required for installation.

C. Use lock washers with all pipe clamps.

D. Secure all loose equipment, tools and debris from falling from the gridiron and galleries during all phases of the installation.

E. At the end of each day during the installation period, remove all refuse and scrap materials to collection points specified by the Owner Upon completion of the installation, leave all areas broom clean.

F. Locate all loose system parts as directed by the Owner.

3.4 PROTECTION OF EQUIPMENT

A. Protect the equipment in this Section from damage and deterioration, including rust, during all phases of the work, from the time of manufacture to installation.

B. Notify the General Contractor or Construction Manager in writing of jobsite conditions that would adversely affect the equipment after installation. Do not install the equipment if jobsite conditions beyond the control of the Rigging Contractor will result in damage or deterioration, including rust.

C. Rust resulting from flaws in manufacturing and finishing shall be covered under the Warranty.

3.5 FIELD QUALITY CONTROL

A. CEOR's representative shall inspect the rigging installation prior to Substantial Compensation of the project and issue a statement that rigging is in compliance with the stamped drawings.

3.6 CLEANING AND REPAIR

A. When construction is complete, restore all system components to their delivered condition. This includes dusting, cleaning, and removal of construction materials such as fireproofing.

B. Repair any work or finishes that are damaged during installation by the Contractor for the work in this Section. This includes the work in this Section and the work of others. Where the work of others is damaged, reimburse the appropriate contractor for the repair.

3.7 OPERATION OF EQUIPMENT

A. Prior to completion of the installation and turnover to the Owner, the equipment in this section shall be operated by employees of the Contractor, those authorized by the Contractor, or those under the Contractor's supervision.

B. The Contractor shall advise the General Contractor or Construction Manager in writing of any unauthorized operation of the equipment.

3.8 DRAPERY INSTALLATION

A. Hang all draperies as directed by the Owner for inspection and acceptance. If the Owner requests, return the draperies to their storage bags and hampers after inspection. The Owner shall assume responsibility for soiling and damage after acceptance.

B. Do not hang the draperies if environmental conditions in the building will be detrimental to the goods. Notify the Architect and the General Contractor or Construction Manager in writing of any adverse environmental conditions.

3.9 COMMISSIONING AND PUNCHLISTING

A. The Contractor shall work with the General Contractor or Construction Manager to arrange for a punchlisting period for the work in this Section. The punchlisting period shall take place at least 1 month before the first scheduled rehearsal on stage. Punchlisting shall consist of a minimum of an 8-hour day. The building schedule shall be such that no other conflicting or obstructing activity is taking place. Punchlisting shall include the operation of every component of each system specified here, including individual counterweight sets.

B. Prior to punchlisting, the Rigging Contractor shall commission the system and certify that the installation is complete and ready for punchlisting by the Theatre Consultant. If substantial portions of the installation are not complete, requiring the Consultant to make another punchlist trip, the Rigging Contractor shall compensate the Consultant for time spent and travel expenses. Compensation shall be at the Consultant’s prevailing hourly and per diem rates.

3.10 TRAINING

A. Assist the Owner in becoming familiar with the completed installation and personally instruct representatives of the Owner in the proper operation and maintenance of all equipment provided. Training shall be a minimum of 4 hours.

3.11 OWNER'S ACCEPTANCE

A. The Owner will accept the work in this Section upon the satisfactory completion of all punch list items.

B. Prior to final acceptance, the Owner reserves the right to use any completed portion of the work in this Section at no additional cost, unless said use poses a potential hazard to personnel or risks damage to the work in this Section or the work of others.

C. The Warranty period shall commence upon final acceptance by the Owner.

END OF SECTION

SECTION 11 61 43 – DRESSING ROOM CURTAIN ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes dressing room curtains and miscellaneous accessories and materials for complete installations.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated and required.
B. Samples for Verification: Minimum 12-inch-square Sample of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat if applicable. Mark top and face of fabric.
C. Product Certificates: For each type of product, signed by product manufacturer.

1. Fabric: Give name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain curtain assembly from single manufacturer. Obtain each color, grade, finish, type, and variety of fabric from single source with resources to provide materials of consistent quality in appearance and physical properties.
B. Fire-Test-Response Characteristics: Provide stage curtains with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame-Resistance Ratings: Class A.

1.4 DELIVERY, STORAGE AND HANDLING

A. Upon delivery, store materials under cover in a dry and clean location, off the ground. Delivered materials which are damaged or otherwise not suitable for installation shall be removed from the job site and replaced with acceptable materials at no cost to the College.

1.5 SITE CONDITIONS

A. Environmental Limitations: Do not install assemblies until space is enclosed and weathertight, wet work in space is complete and dry, work at and above ceiling is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
B. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable curtain manufacturers:

1. Basis of Design: Carnegie Fabrics, Carnegiefabrics.com

a. Style: Bijoux 6868
b. Color:10

c. Finish: None

2. Or equal.

B. Acceptable curtain track and accessory manufacturers:

1. To be determined.
2. Or equal.

2.2 MATERIALS

A. Curtain: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment to comply with requirements indicated. Provide fabrics from the same dye lot.
B. Curtain tracks and accessories:

1. Design is based on tracks by manufacturers listed above. Subject to compliance and requirements, provide the named product or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.
B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CURTAIN TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.
B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.3 CURTAIN INSTALLATION

A. Where curtains abut overhead construction, hang curtains so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).
B. Where curtains extend to floor, install so that bottom hems clear finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm).
C. Insert other length requirements if necessary to suit Project.

3.4 ADJUSTING

A. After hanging curtains, test and adjust each curtain track to produce unencumbered, smooth operation.
B. Steam and dress down curtains as required to produce crease- and wrinkle-free installation.
C. Remove and replace curtains that are stained or soiled.

3.5 PROTECTION

A. Take suitable precautions to protect the entire assembly from damage after installation and prior to acceptance by the Owner.

END OF SECTION

1. Description: A-Size Template Holder for ERS
   Manufacturer: City Theatrical #2150
   Quantity: 6

2. Description: Drop-In Iris for ERS
   Manufacturer: City Theatrical #2180
   Quantity: 2

3. Description: Stackable Top Hat for 19°-50° ERS
   Manufacturer: City Theatrical #2840
   Quantity: 36 Cable Assemblies

4. Description: Wireless DMX Transmitter w/ 10’ DMX cable
   Manufacturer: City Theatrical Multiverse SHoW Baby CT-5900
   Quantity: 1

5. Description: Pipe Mount Relay/Wireless DMX Receiver
   Manufacturer: ETC #CSR-M, CSR-PMT, 400CC, 400SC
   Quantity: 3

B. All cable assemblies shall be tested after fabrication to assure wire continuity and correct polarity of connections.

C. All cable assemblies shall include shrink wrapped identification label with text “VAPA” beneath shrink wrap.

D. All cable assemblies shall include shrink wrapped length label with length text beneath shrink wrap at each end.

E. DMX512 (5-pin XLR) data cable assemblies shall consist of ruggedized cable, terminating at each end to Neutrik XX-Series XLR5 connectors with black shell. Assemblies shall be terminated in accordance with USITT (United States Institute for Theatre Technology) DMX512 specification.

1. Furnish (20) cable assemblies of 5’-0” length.
2. Furnish (10) cable assemblies of 10’-0” length.
3. Furnish (10) cable assemblies of 25’-0” length.
4. Furnish (5) cable assemblies of 50’-0” length.
5. Furnish (1) cable assemblies of 100’-0” length.

F. Edison Extension assemblies shall consist of 12/3 SOOW cables, terminating at each end with a NEMA 5-20 receptacle.

1. Furnish (10) cable assemblies of 5’-0” length.
2. Furnish (10) cable assemblies of 10’-0” length.
3. Furnish (5) cable assemblies of 25’-0” length.
4. Furnish (2) cable assemblies of 50’-0” length.

G. Adapter assemblies shall consist of 12/3 SJOW cables, terminating at one end with a 20A stage pin receptacle and the other end with a connector as indicated below.

1. Furnish (5) Male 15A Edison to Female 20A stage pin Adapter assemblies of 5’-0” length.

2.4 TOOLS, STORAGE, & SUPPLIES

A. Furnish the following additional items:

1. Description: Heavy Duty 30” x 30” Cable Trunk w/ 4” Casters
   Quantity: 1

2. Description: 2”x180’ Black Pro Gaff Gaffers Tape
   Quantity: 24 rolls (1 case)

3. Description: 2”x75’ Blacktak Masking Foil
   Quantity: 1 roll

4. Description: 3000’ 1/8” Black Cotton Unglazed Tie-Line
   Quantity: 1 Spool

PART 3 – EXECUTION

3.1 SHOP PREPARATION

A. Install connectors for all fixtures prior to delivery.

B. Test all fixtures prior to packing for delivery.

3.2 DELIVERY

A. Bidder is responsible for coordinating delivery times per the Owner’s schedule; delivery FOB to Compton, CA.

3.3 PROTECTION OF EQUIPMENT

A. Protect the equipment in this Section from damage and deterioration during all phases of the work, from the time of manufacture to the acceptance of the completed installation.

END OF SECTION

SECTION 11 61 63 - LOOSE PERFORMANCE LIGHTING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies loose performance lighting equipment, including the following:

1. Performance Lighting Fixtures
2. Fixture Accessories
3. Lamps
4. Cable Assemblies
5. Stage Hardware
6. Tools, Storage & Supplies

B. Work not included

1. Hang and focus; installation of fixtures shall be by owner.

C. Related sections include the following:

1. Performance Lighting Systems
2. Performance Lighting Systems Installation
3. Common Work Results for Electrical
4. Interior Lighting Fixtures
5. Rigging Systems and Draperies
6. Commissioning of Electrical Systems

1.3 ACCEPTABLE VENDORS

A. The equipment shall be supplied by only one of the following:

1. 4Wall Los Angeles
   5435 W. San Fernando Road
   Los Angeles, CA 90039
   818.252.7481
2. BCT Entertainment
   1281 N La Loma Circle
   Anaheim, CA 92806
   714.237.9270
3. Polaris Lighting
   624 Irving Ave
   Glendale, CA 91201
   818.265.0330
4. PRG Los Angeles
   1245 Aviation Place
   San Fernando, CA 91340
   818.252.2600b
5. Pro Sound & Video
   11060 Randall Street
   Sun Valley, CA 91352
   818.765.3800

1.4 SUBMITTALS

A. Submit a complete bill of materials for each product listed herein.

B. Submit product data sheets for all items for approval prior to shipment.

1.5 QUALITY ASSURANCE AND STANDARDS

A. Instruments shall be fabricated according to the standards of Underwriters' Laboratories, Inc. and shall be labeled to attest UL listing.

B. Warrant the equipment to be free to defects in materials and workmanship for a period of one year from the date of acceptance by the Owner. The warranty shall specifically include, but not be limited to, lamp sockets, lenses, shutters, and clamps. If any item proves defective within the warranty period it shall be replaced at no cost to the Owner.

PART 2 – PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

A. Instruments shall be free of light leaks and spurious reflections adjacent to their fields.

B. Instrument fields shall be visually uniform and without hot spots, holes, stripes, or rings.

C. Instruments shall be ventilated and/or conductively cooled to maintain temperature ratings set by lamp manufacturers.

D. Exterior finishes shall be matte black high temperature enamel.

E. Pigtails shall be 36 inches long unless otherwise noted.

F. Pipe clamps shall be C-Clamp type for 1.9" (48mm) O.D. pipe unless otherwise noted. Pipe clamps shall be fitted with a spacer between clamp and yoke to permit 360° rotation.

G. Color frames, safety cables, top hats, donuts, barn doors and other similar accessories shall be finished in matte black high temperature paint.

H. Instruments that require DMX data shall be self-terminating. For instruments that are not self-terminating, DMX terminators shall be provided for 10% of the instrument quantity.

2.2 PERFORMANCE LIGHTING FIXTURES

A. Furnish the following stage lighting fixtures:

1. Description: TBD° LED Spot Light
   Manufacturer: Electronic Theatre Controls #CSSPOTS
   Accessories: Matte Black Color Frame, Pipe Clamp, Safety Cable, TBD LED EDLT Lens Tube
   Connector: 15A Edison NEMA 5-15
   Quantity: 36

2. Description: LED Wash Light
   Manufacturer: Electronic Theatre Controls #CSPAR-DB
   Accessories: Matte Black Color Frame, Pipe Clamp, Safety Cable
   Connector: 15A Edison NEMA 5-15
   Quantity: 12

2.3 FIXTURE ACCESSORIES

A. Furnish the following fixture accessories:

1. Description: A-Size Template Holder for ERS
   Manufacturer: City Theatrical #2150
   Quantity: 6

2. Description: Drop-In Iris for ERS
   Manufacturer: City Theatrical #2180
   Quantity: 2

3. Description: Stackable Top Hat for 19°-50° ERS
   Manufacturer: City Theatrical #2840
   Quantity: 36 Cable Assemblies

4. Description: Wireless DMX Transmitter w/ 10’ DMX cable
   Manufacturer: City Theatrical Multiverse SHoW Baby CT-5900
   Quantity: 1

5. Description: Pipe Mount Relay/Wireless DMX Receiver
   Manufacturer: ETC #CSR-M, CSR-PMT, 400CC, 400SC
   Quantity: 3

B. All cable assemblies shall be tested after fabrication to assure wire continuity and correct polarity of connections.

C. All cable assemblies shall include shrink wrapped identification label with text “VAPA” beneath shrink wrap.

D. All cable assemblies shall include shrink wrapped length label with length text beneath shrink wrap at each end.

E. DMX512 (5-pin XLR) data cable assemblies shall consist of ruggedized cable, terminating at each end to Neutrik XX-Series XLR5 connectors with black shell. Assemblies shall be terminated in accordance with USITT (United States Institute for Theatre Technology) DMX512 specification.

1. Furnish (20) cable assemblies of 5’-0” length.
2. Furnish (10) cable assemblies of 10’-0” length.
3. Furnish (10) cable assemblies of 25’-0” length.
4. Furnish (5) cable assemblies of 50’-0” length.
5. Furnish (1) cable assemblies of 100’-0” length.

F. Edison Extension assemblies shall consist of 12/3 SOOW cables, terminating at each end with a NEMA 5-20 receptacle.

1. Furnish (10) cable assemblies of 5’-0” length.
2. Furnish (10) cable assemblies of 10’-0” length.
3. Furnish (5) cable assemblies of 25’-0” length.
4. Furnish (2) cable assemblies of 50’-0” length.

G. Adapter assemblies shall consist of 12/3 SJOW cables, terminating at one end with a 20A stage pin receptacle and the other end with a connector as indicated below.

1. Furnish (5) Male 15A Edison to Female 20A stage pin Adapter assemblies of 5’-0” length.

2.4 TOOLS, STORAGE, & SUPPLIES

A. Furnish the following additional items:

1. Description: Heavy Duty 30” x 30” Cable Trunk w/ 4” Casters
   Quantity: 1

2. Description: 2”x180’ Black Pro Gaff Gaffers Tape
   Quantity: 24 rolls (1 case)

3. Description: 2”x75’ Blacktak Masking Foil
   Quantity: 1 roll

4. Description: 3000’ 1/8” Black Cotton Unglazed Tie-Line
   Quantity: 1 Spool

PART 3 – EXECUTION

3.1 SHOP PREPARATION

A. Install connectors for all fixtures prior to delivery.

B. Test all fixtures prior to packing for delivery.

3.2 DELIVERY

A. Bidder is responsible for coordinating delivery times per the Owner’s schedule; delivery FOB to Compton, CA.

3.3 PROTECTION OF EQUIPMENT

A. Protect the equipment in this Section from damage and deterioration during all phases of the work, from the time of manufacture to the acceptance of the completed installation.

END OF SECTION

DIVISION 12
FURNISHINGS

SECTION 12 22 00 - CURTAINS AND DRAPES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Drapes, see PF-1 on the Interiors Finish Materials sheet on Drawings.
2. Drapery tracks.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Drapery Tracks: Include maximum weights of drapes that can be supported.
2. Fabrics.
3. Textile treatments.

B. Shop Drawings:

1. Drapery Tracks: Show installation and anchorage details and locations of controls.
2. Drapes: Show sizes, locations, and details of installation.

C. Samples: As follows:

1. Drapery Tracks: 18 inches long, with carriers, controls, and accessories.
2. Drapery Fabrics: For each color and pattern indicated, full width by 36 inches long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.
3. Textile Trims: For each color and pattern indicated, 18 inches long.
4. Drape Fabrication: For each heading, fabric, color, and pattern indicated, a complete full-

D. Product Certificates: For each drapery fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: For drapes and drapery tracks, fabricator of drapes.
1. completed Work if undisturbed at time of Substantial Completion.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.
B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

A. Manually Operated Track:
1. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches o.c.
   a. Lengths and Configurations: As indicated on Drawings.
   b. Support Capability: Weight of drape indicated mounted on track length indicated.
   c. Finish: White baked enamel.
2. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drape plus force applied to operate track.
   a. Mounting Surface: Ceiling.
   b. Size: As shown on Drawings.
3. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
4. Operation: Baton.
   a. Operating Hardware Location: On stack side.
5. Carriers: Slides with hooks.
6. End Stops: Manufacturer's standard with track end cap.
7. Kirsch track in white, basis of design, or equal. Distributer: Kurt Luginguhl with Interior Services I Draperies, Blinds & Shades, 626 358 4411 x 117.
8.

2.2 DRAPES

A. Manufacturer: Carnegie Fabrics, Distributer: Kurt Luginguhl with Interior Services I Draperies, Blinds & Shades, 626 358 4411 x 117.
   1. Style: Bijoux 6868
   2. Color: 10.

B. Or equal.
C. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.
D. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
E. Drape at Spec Class Lab:
   1. Heading:
      a. Ripplefold with 60% Fullness.

2.3 DRAPE FABRICATION

A. Fabricate drapes in heading style and fullness indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. One-Way-Stacking Drapes: Add 5 inches to overall width for returns.

B. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are unacceptable.
C. Side Hems: Double-turned, 1-1/2-inch-wide hems consisting of three layers of fabric, and blindstitched so that stitches are invisible on face of drape.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.
B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPE INSTALLATION

A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch.
B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.
C. Where drapes extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch.

3.3 ADJUSTING

A. After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.
B. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.
C. Remove and replace drapes that are stained or soiled.

END OF SECTION

SECTION 12 24 16 - ROLLER SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Electrically operated, sunscreen and blackout roller shades (MS-1, MS-2 & MS-3).
2. Intelligent encoded electronic drive system
3. Motor controls, interfaces, and accessories.

1.2 RELATED SECTIONS

A. Section 09 22 16 – Non-Structural Metal Framing: Metal backing plates for mounting roller shades and accessories.
B. Section 09 29 00 - Gypsum Board: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
C. Section 09 51 13 - Acoustical Panel Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
D. Division 26 - Electrical: Electric service for motor controls.
E. Work furnished, but installed in other Sections:

1. Metal shade pockets or housings recessed into ceiling systems, and extruded aluminum ceiling pocket trim (closure) assemblies.
2. Electrical control components including switches and relays necessary for control characteristics specified.

F. Related requirements: Division 26 for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: One week prior to commencing work related to this section. Require attendance of all affected installers.
C. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
2. Do not install shades until final surface finishes and painting are complete.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog pages and data sheets for products specified including materials, finishes, dimensions, profiles, mountings, and accessories.

1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes , accessories, and operating instructions.
3. Storage and handling requirements and recommendations.

4. Mounting details and installation methods.
5. Manufacturer's Instructions: Include storage, handling, protection, examination, preparation, and installation.
6. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
7. Operation and Maintenance Data: Component list with part numbers, and operation and maintenance instructions.
8. Motorized Shades: Power requirements. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

1. Prepare shop drawings. Show locations and size of backing required for installation of shades.
2. Prepare control wiring diagrams based on zones, switching and operational requirements provided by the Architect in electronic format.
3. Include one-line diagrams, wire counts, coverage patterns, and physical dimensions of each item.
4. Provide location plan showing all switch and control zones as per the performance requirements of the specifications. All switches, sensors and other control accessories must clearly be shown and called out in a bill of materials.
5. Provide location plan showing all manual shade control locations. Cross-reference furniture plans for optimal positioning of chains.
6. Provide elevation drawings showing shade band layout. Indicate any necessary seam or batten locations.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.

1. Shadecloth Sample: Mark face of material to indicate interior faces.

a. Test reports indicating compliance with specified fabric properties.
b. Verification Samples: 6 inches (150 mm) square, representing actual materials, color and pattern.

E. Maintenance Data: Bill of materials for all components with part numbers. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Warranty: Provide manufacturer’s warranty documents as specified in this Section.

G. Maintenance contracts.

H. Manufacturers’ instructions: Manufacturer standard installation instructions.

I. Window treatment schedule: Include roller shades in schedule using same room designations indicated on Drawings.

J. Qualification data: For Installer.

K. Maintenance data: Furnish maintenance manuals with the following information:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.5 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.

C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

1. Requirements for Roller Shade Installer/Contractor:

a. Roller Shade Hardware, shade fabric, motor, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

b. Roller Shade Installer/Contractor shall list all components and systems included in their bid, including but not limited to, the prime manufacturer of the motor control and automated equipment and shall be financially responsible for any change orders and/or back charges required by the BMS, AV, or Lighting Control Systems contractors to interface with the automatic solar tracking system and the motorized roller shade system.

D. Product Listing Organization Qualifications: Organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

F. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

G. Requirements for Electronic Hardware, Controls, and Switches: Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

H. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644 and ATCC9645, and E2180.

I. ShadeCloth Cleanability and Disinfecting: ShadeCloth must meet cleanability and disinfecting requirements via 3rd party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19.

J. Turn-Key Single-Source Responsibility for Wiring Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:

1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
3. Contractor shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.

4. Contractor shall provide and run all line voltage (from the terminating points) to the motor controllers. Roller shade dealer/installer shall wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit (provided by Electrical Subcontractor), as required by the electrical code having jurisdiction.
5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

K. Mockup: Build a full size motorized shade mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Locate mock-up in window designated by Architect.
2. Mockup Size: Full size.
3. Mockup Size, one motorized panel: 3 x 3 feet minimum.
4. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
5. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
6. Do not proceed with remaining work until, mock-up is accepted by Architect.
7. Retain mock-up during construction as a standard for comparison with completed work.
8. Do not alter or remove mock-up until work is completed or removal is authorized.
9. Full-sized mock-up may become part of the final installation.

L. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

M. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644 and ATCC9645, and E2180.

1.6 HANDLING

A. Storage and protection:

1. Do not deliver items to the Project until all wet work has been completed and is dry.
2. Deliver shades to Project site in labeled protective packaging, uniquely labeled to identify each shade for each opening, using same room designations indicated and scheduled.
3. Schedule delivery to prevent delays to completion of work but to minimize on site storage time.
4. Store materials in a dry secure place. Protect from weather, surface contaminants, corrosion, construction traffic and all other potential damage.

1.7 PROJECT CONDITIONS

A. Environmental limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent specified in other sections.

1. 485, ICON, Lonmark and Dry Contract Network: Noise on the line not to exceed shade manufacturer's limits.

C. Field measurements:

1. Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies.

1.8 WARRANTIES

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating warranty for interior shading.

1. Shade Hardware:

a. Mecho/7 including bead chain with Soho or Classic Blackout shade fabric: 25 years.
b. ElectroShade with Soho or Classic Blackout shade fabric: 25-years.

2. Standard Shadecloth: Manufacturer's standard 25-year warranty.
3. Roller Shade Motors, Motor Control Systems, and Accessories: Manufacturer's standard non-depreciating 5-year warranty for AC motors and 5-year warranty for DC motors.
4. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owners responsibility.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. See MS-1, MS-2 and MS-3 on sheet A610 -Interior Finish Materials sheet.
B. Basis of design: MechoShade Systems, Inc.; as represented by ARCHITYPE, Tel: (213) 631-5001. Fax: (213) 884-4790, Contact: Jean-Guy Poitras. Email: jean-guy.poitras@mechoshade.com ; jeanguy@architype.net or Kurt Luginguhl with Interior Services I Draperies, Blinds & Shades, 626 358 4411 x 117.
C. Or equal.

2.2 APPLICTION/SCOPE

A. Roller Shade Schedule:

1. Motorized interior sunscreen roller shades in all exterior / interior windows of rooms and spaces as shown on referenced Drawings, and related EDU control requirements systems. Include the following as scheduled and as indicated on the Drawings:

a. Recessed shade pockets.
b. Surface-mounted fascia boxes.
c. Provide room darkening side and sill channels at MS-2.

2. Motorized operating, chain drive, Urban room darkening opaque roller shades and related mounting systems and accessories on all door windows as indicated on drawings.

2.3 ROLLER SHADES, MOTORIZED OPERATION AND ACCESSORIES

A. Shade System; General:

1. Motorized Shades: Comply with NFPA 70.
2. Components capable of being removed or adjusted without removing mounted shade brackets, cassette support channel.
3. Operates smoothly when raising or lowering shades.
4. Cradle-to-Cradle certified and listed in C2C (DIR).
5. Electrical Components: Listed, classified, and labeled as suitable for intended purpose. Test as total system. Individual component testing is acceptable.

a. Components: FCC compliant where applicable.

B. Basis of Design: ElectroShade with WhisperShade IQ2 EDU. As manufactured by MechoShade Systems LLC. Motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.

1. Voltage: 120 VAC – Base Bid
2. Description: Single roller.
3. Drop Position: Regular roll.
4. Mounting: Wall mounted.
5. Size: As indicated on drawings.
6. Fabric: As indicated under Shade Fabric article.
7. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    a. Material: Steel, 1/8 inch (3 mm) thick.
    b. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
8. Roller Tubes:
    a. Material: Extruded aluminum.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
9. Hembars: Designed to maintain bottom of shade straight and flat.
    a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
10. Accessories:
    a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
        1) Finish: To be selected from manufacturer's standard finishes.
        2) Capable of installation across two or more shade bands in one piece.
        3) Profile: Square.
        4) Configuration: Captured and continuous, as indicated on drawings.
    b. Ceiling Pockets: Premanufactured metal shade pocket with removable closure panel, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.

2.4 INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

A. Electronic Drive Unit (EDU) System General Requirements:

1. A UL 325 listed solution.
    a. Component certification in lieu of system testing is not acceptable.
2. Listing Label and Motor Rating: To be visible for inspection without dismounting of shade assembly to remove motor or EDU from shade roller tube.
3. Size and Configuration: As recommended by manufacturer for type, size, and arrangement of shades.
4. Conceal EDU inside shade roller tube.
5. EDU Rated Speed: The same nominal speed for shades in the same room.
6. Hanging Weight of Shade Band: 80 percent of rated lifting capacity of shade EDU and tube assembly.
7. Capable of upgrading firmware from anywhere on network without touching the motor.

B. Line Voltage EDU (120 VAC):

1. Basis of Design: MechoShade Systems LLC; WhisperShadeIQ2 System. Tubular, asynchronous, integral AC motor and reversible capacitor. 120 VAC, single phase, 60 Hz; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by line voltage power supply connection equipped with locking disconnect plug assembly furnished with EDU.
2. Audible Noise: 46 dBA measured 3 ft (914 mm) from motor unit, depending on motor torque.
3. Nominal Speed: 34 RPM. Not to vary due to load/lift capacity.
4. Isolated, low voltage power supply for powering external accessories connected to either the dry contact or network port.

    a. Products requiring accessories to be powered by a plug-in or externally-supplied power supply are not acceptable.

C. Modes of Operation:

1. Uniform Mode: Shades move to defined intermediate stop positions in order to maintain aesthetic uniformity.
2. Normal Mode: Shades move to defined intermediate stop positions and any position between defined upper and lower limits.
3. Maintenance Mode: Prevents shade from moving via dry contact or network control commands mode has been cleared/disabled.

D. D. Control Methods: Local isolated dry contact input and network control.

1. Local Isolated Dry Contact Inputs:

    a. Local switch control, third party system integration without separate interface.
    b. Moving EDU/shade to upper and lower limits and local switch preset positions.
    c. Configuration of upper and lower limits, custom presets, and key modes of operation without a PC or microprocessor-based tools.
    d. Configuration under protected sequences to prevent changes by casual user.
    e. Switch Personalities: Configuration of dry contact control port over network such that any type of dry contact keypad/third-party interface and actuation methodology (maintained and/or momentary actuation) can be used to operate shade.
    f. Dry Contact Control Connection Options to Include:

        1) One-button.
        2) Two-button.
        3) Three-button. Able to support configuring limits, presets, and key operating modes (default).
        4) Three-button. No configuration capability to prevent accidental changes in settings.

2. Network Control:

    a. Bi-directional network communication to enable commanding operation of large groups of shades over a common backbone.
    b. Each EDU:

        1) Support eight network addresses capable of being employed for various levels of group control.
        2) Dry Contact Ports: Assigned its own local switch address which can be matched by other EDUs within eight network addresses in order to support group control when dry contact commands are received.

a) The EDU receiving dry contact commands may or may not be configured to operate based on commands coming through its own dry contact input port.

3) To have an independent unique identifier address (UID) enabling EDU to be independently controlled and configured over network via handheld configurator and/or PC controller.

c. Network Communication Card: Integral with tubular EDU assembly.
d. Support configuration of upper and lower limits using either a handheld removable program module/configurator or a local switch.
e. Support configuration of addresses using a handheld removable program module/configurator.

E. Alignment Positions:

1. Repeatable and precisely aligned shade positions and limits.

a. Support positioning commands from 0 to 100 percent in 1 percent increments.
b. Customizable Presets: 32.
c. Include three intermediate dry contact presets

2. Shades on same switch circuit or same network group address with same opening height, to align at each intermediate stopping position when traveling from any position, up or down.
3. Shades of differing heights: Capable of custom, aligned intermediate stop positions when traveling from any position, up or down.
4. Alignment of shade bands mechanically aligned on same EDU: Plus or minus 0.125 inch (3 mm).
5. Alignment of standard shades on adjacent EDUs: Plus or minus 0.25 inch (6 mm) when commanded to same alignment position.

F. Local Switch Presets:

1. Minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
2. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to 25, 50, and 75 percent of shade travel).
3. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.

G. Network Presets:

1. Minimum of 32 customizable preset positions (including the three local switch presets) accessible via network commands.
2. Preset positions: Customizable to any position between and including defined upper and lower limits (initially defaults to defined lower limit).
3. Configuration of Custom Preset Positions: A handheld removable program module/configurator or a local switch.

2.5 MOTOR CONTROLS, INTERFACES, AND ACCESSORIES

A. Unless indicated to be excluded, provide required equipment as necessary for a complete operating system providing the control intent specified. Provide components and connections necessary to interface with other systems as indicated.

B. Digital Network Controls:

1. Basis of Design: MechoShade Systems LLC; MechoNet. Low-voltage network utilizes standard Category 5/6 UTP cable; maximum of 4,000 feet (1,219 m), 250 nodes.
2. Reprogram control without requiring wiring modifications.
3. Ten-year non-volatile power failure memory for system configuration settings.

4. Network Interface Components:
    a. MechoNet Network Interface; MNI Series: Four configurable motor/EDU ports (models available for RJ45 or terminal block wiring); four configurable switch ports; one infrared (IR) remote control port; one configurable serial port for RS232/RS485 communication.
    b. IQ2 Dual Splitter: Two motor/EDU ports; two switch ports.
    c. IQ Gateway; one for each floor where controlling across multiple floors.

C. Low-Voltage Wall Controls; IQ Switch:
1. Momentary dry contact switch enables manual local control or network control of any individual shade motor or shade group/sub-group on MechoNet network.
2. Control Functions:
    a. Open: Automatically open controlled shades to fully open position when button is pressed.
    b. Close: Automatically close controlled shades to fully closed position when button is pressed.
    c. Presets: For selection of predetermined shade positions.
    d. Dual Stations: For individual control of two shades/groups.
3. Finish: White.
4. Single Station: 5-button (open, close, and three intermediate stop positions).
5. Double Station: 10-button (open, close, and three intermediate stop positions for each of two shades/groups).

2.6 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
2. Horizontal Dimensions: Outside mounting.
    a. Cover window frames, trim, and casings completely.

C. Openings Requiring Continuous Multiple Shade Units with Separate Rollers: Locate roller joints at window mullion centers; butt rollers end-to-end.

2.7 SHADE FABRIC

A. Basis of Design: Shade fabric as manufactured by MechoShade Systems LLC.
1. Solar Shadecloths:
    a. Fabric: EcoVeil Sheer: 6850 series. Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (1 percent open). The first shadecloth to pass NFPA 701 flame tests without added chemical flame retardants. NRC Rating: 0.50. SAA Rating: 0.53.
    b. Color: Graphite.
2. Blackout Shadecloths:
    a. Fabric: Classic Blackout: 0700 series. Opaque. Vinyl coated fabric blackout material same color reverse side (for exterior).
    b. Color: Graphite.
3. Performance Requirements:
    a. Flammability per NFPA 701: Pass. Large or small scale test.
    b. Fungal Resistance: No growth when tested per ASTM G21.

c. Cleanability and Disinfecting: ShadeCloth must meet cleanability and disinfecting requirements via 3rd party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
B. Correct detrimental conditions before proceeding with installation.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
C. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 SHADE INSTALLATION

A. Install shades level, plumb, square, and true per manufacturer's instructions and approved shop drawings. Locate so shade band is at least 2 inches from interior face of glass. Allow proper clearances for window operation hardware. Use mounting devices as indicated.
B. Replace shades exceeding specified tolerances at no extra cost to Owner.
C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric.
D. Clean roller shade surfaces after installation, per manufacturer's written instructions.
E. Demonstrate operation and maintenance of window shade system to Owner's personnel.
F. Install units within the following tolerances:

1. Maximum variation of gap at window opening perimeter: 1/4-inch, per 8 feet (plus or minus 1/8-inch) of shade height.
2. Maximum offset from level: 1/16-inch per 5 feet of shade width.

G. Allow clearances for window operation hardware.
H. Connect motorized operators to building electrical system.

3.4 ADJUSTING

A. Adjust and balance shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.5 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.
B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: Design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified is to be performed by a single manufacturer and their authorized installer/dealer.

1. The Architect will not provide a set of electrical drawings for installation of control wiring for motors, or motor controllers of motorized roller shades.

2. Power wiring (line voltage), to be provided by roller shade installer/dealer, per requirements provided by manufacturer. Coordinate following with roller shade installer/dealer:
3. Contractor To Provide the Following:
    a. Power Panels and Circuits: Size to accommodate roller shade manufacturer's requirements, as indicated on mechanical and electrical drawings.
    b. Coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
    c. Line voltage as dedicated home runs, of sufficient quantity, and capacity as required. Terminate in junction boxes at locations designated by roller shade installer/dealer.
    d. Run line voltage from terminating points to motor controllers. Wire roller shade motors to motor controllers. Run low voltage control wiring from motor controllers to switch/control locations designated by Architect.
        1) Above-ceiling and concealed wiring to be plenum-rated, or in conduit, as required by the electrical code having jurisdiction.
    e. Use conduit with pull wire in areas, not accessible to roller shade contractor due to building design, equipment location or schedule.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation, conduct tests to ensure the proper operation of the shades.
B. Adjust and lubricate as required for safe and efficient operation.
C. Restore marred or abraded surfaces to original condition using same primer used for shop painting.

3.7 DEMONSTRATION

A. Manufacturer's authorized personnel are to train Owner's personnel on operation and maintenance of system.
    1. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.
    2. 1. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

3.8 PROTECTION AND CLEANING

A. Clean shade surfaces after installation in compliance with their manufacturer's instructions.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that shades are without damage or deterioration at Substantial Completion.
C. Replace damaged shades that cannot be repaired, in a manner approved by Architect, before Substantial Completion.

END OF SECTION

SECTION 12 36 61 - QUARTZ SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes quartz surfacing for countertops, and backsplashes (SLS-1).
B. Related requirements:

1. Division 07 for perimeter sealant to adjacent construction.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling and sequencing:
B. Preinstallation meeting:

1.3 REFERENCES

A. Architectural Woodwork Institute “North American Architectural Woodwork Standard Section 11, “Premium Grade.”

1.4 SUBMITTALS

A. Data: Manufacturer Product Data, sample warranty form, fabrication and installation instructions.
B. Shop Drawings:

1. Indicate materials, show fabrication details, field jointing, adjacent construction and methods of support and anchorages, and integration of plumbing components.
2. Dimension position of openings required, with rough-in sizes. Provide templates for cast-in or placed frames or anchors; tolerances for item placement and temporary bracing of components.

C. Samples:

1. Three-inch square samples representative of color, texture and finish to be expected for final product. Finish all exposed edges same as for exposed face.
2. Variation in distribution of aggregates in quartz surfacing in stock that will be used for the Project must be approved by the Architect prior to fabrication.

D. Manufacturer's certificate: Certification that product meets or exceeds specified requirements for stain resistance.
E. Fabricator qualifications: Evidence of fabricator qualifications.
F. Closeout:

1. List of approved cleaning materials and procedure required and provide list of substances that are harmful to product.
2. Include instructions for stain removal, surface and gloss restoration and scratch removal.

1.5 QUALITY ASSURANCE

A. Regulatory requirements: Conform to Code for flame/smoke rating in accordance with ASTM E 84.
B. Fabricator qualifications: Firm specializing in fabrication of products specified with minimum 3 years documented successful experience.
C. Color match: Materials for the Project shall be from the same batch and shall bear labels with same batch number. Visually inspect materials to be used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on Project.

1.6 HANDLING

A. Packaging, shipping, handling, and unloading:

1. Observe manufacturer's recommendations and handle in manner to prevent breakage or damage.
2. Brace parts if necessary.
3. Transport in the near-vertical position with finished face to finished face.
4. Do not allow finished surfaces to rub during shipping or handling.

B. Storage and protection:

1. Store in racks in near-vertical position. Prevent warpage and breakage.
2. Store inside away from direct exposure to sun between 25- and 130-degree F.
3. Store with finished face toward finished face.

1.7 WARRANTY

A. Ten-year warranty against cracking, softening and discoloration of the countertops.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/MATERIALS

A. Quartz surfacing: See SLS-1 on sheet A610 -Interior Finish Materials sheet.

1. US Quartz Products Inc. "CaesarStone Quartz Surfacing" (basis of design).
2. DuPont "Zodiac Quartz Surfacing."
3. Consentino "Silestone."
4. Samsung "Staron."
5. Or equal.

2.2 PERFORMANCE REQUIREMENTS:

A. Performance:

1. Flexural strength: 7,420 psi, ASTM C880.
2. Compressive strength: ASTM C-170.

a. Dry: 10,430 psi average.
b. Wet: 11,265 psi average.

3. Izod impact strength: 0.361-foot lbs./inch of notch average; ASTM D256.
4. Bond Strength: 205 psi; ASTM C482 modified.
5. Modulus of rupture: 2,110 average, ASTM C99.
6. Mohs hardness: 6.5-7.5; scratch test.
7. Absorption: 0.022 percent; ASTM C97.
8. Stain and Acid Resistance: Not affected; ASTM D2299.
9. Surface burning characteristics:

    a. Flame spread: 10.
    b. Smoke density: 195; ASTM E84.

10. Wear resistance: 36.12 gram average; ASTM C501, tested with 1 kg. load, 1000 cycles at 70 rpm.]

2.3 QUARTZ SURFACING

A. Composition: 93 percent crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
B. Identification: Material shall be labeled with batch number and imprinted on back with manufacturer's identifying mark.
C. Color and finish: As selected by the Architect from manufacturer's palette.

2.4 MISCELLANEOUS MATERIALS

A. Adhesive: Type recommended by the quartz surfacing manufacturer.
B. Sealant: As specified in Section 07 92 00.
C. Cleaning agents: Non-abrasive, soft-scrub type kitchen cleansers.

2.5 FABRICATION

A. Color match materials throughout Project shall be from the same batch with labels with same batch number. Visually inspect materials to be used for adjacent pieces to assure acceptable color match. Inspect under lighting conditions similar to those on Project.
B. Fabricate countertops to profiles and dimensions shown in compliance with WI Manual of Millwork Section 16, Premium Grade. Minimize joints.

    1. Finish exposed surfaces smooth and polish to a low sheen.
    2. Radius corners and edges unless otherwise indicated.

C. Cut and drill sinkages and holes for anchors, supports, and attachments.
D. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
E. Fabricate edges with edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners slightly eased, unless otherwise indicated. Miter and glue corners to a hairline using adhesive colored to match stone.
F. Finish exposed faces to match approved Samples. Provide matching finish on the exposed edges of countertops.
G. Fabricate tops without joints, except that where length of exceeds available slab length, locate joints where indicated. Make joints hairline and flush.
H. Fabricate thresholds with a uniform honed (400 to 1,200 grit abrasive) finish on exposed surfaces for a tight fit against door jambs and a smooth transition between tile and adjoining

floor surface. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2-inch or less.

I. Provide backsplashes as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Install countertops in compliance with the approved shop drawings, WI Manual of Millwork for the grade specified, and the quartz surfacing manufacturer's instructions, plumb, level, with tight, flush joints.
B. Anchor with adhesive securely to supports with a maximum variation from true dimension and position of 1/8-inch.

3.3 CLEANING/PROTECTING

A. Clean and polish in compliance with quartz surfacing manufacturer's instructions.
B. Protect finished work from damage by covering with heavy Kraft paper until final cleaning.

END OF SECTION

THIS SECTION IS OWNER-FURNISHED, OWNER-SUPPLIED

SECTION 12 62 19 - STACKING AUDIENCE SEATING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

1. Provide stackable audience seating and related items, as indicated on the drawings, specified herein, and as required to complete the installation.

B. Related sections include the following:

1. Finished stage floor
2. Demountable platforms

1.3 SUBMITTALS

A. Shop drawings shall be of uniform size, bound and include the following:

1. Title sheet listing all sheets in the submittal.
2. Scale plans and elevations.
3. All information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of components in all phases of operation.
4. Country or origin for equipment not manufactured in the United States.

B. Upon completion of the installation, provide 1 reduced set of the shop drawings in a 3-ring binder for the Owner. In addition, provide electronic copies of the shop drawings for the Owner, the Architect and the Theatre Consultant. Electronic copies shall be in PDF format.

C. Provide 1 hard copy of an instruction and maintenance manual for the Owner. In addition, provide electronic copies of the manual for the Owner, the Architect and the Theatre Consultant. Electronic copies shall be in PDF format. The manual shall include:

1. System description.
2. Operation instructions, including safety measures.
3. Maintenance instructions, including recommended procedures and schedules for inspecting system components.
4. Catalog cuts for all purchased equipment

D. Instruction and maintenance manuals shall be provided at the time of Owner training.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Equipment shall be by one of the following:

1. Series International
   20900 NE 30th Ave, Ste 901
   Miami, FL 33180
   Tel: 800.706.3598
2. PS Furniture
   Acton Stacker
   1339 W Mequon Rd, Ste 215

Mequon, WI 53092
Tel: 262.478.3398

3. Clarin
   4010 Uplift
   38 Dyer St Extension
   N. Berwick, ME 03906
   Tel: 207.676.2271

2.2 VENDORS

A. Equipment shall be by one of the following:

1. Polito Associates
   Los Angeles, CA
   Tel: 310.748.3725
2. Spec Seats
   Rancho Domingo, CA 90221
   Tel: 323.954.7100
3. TBD

2.3 CHAIR COMPONENTS

A. Chairs shall have padded, upholstered backs padded, upholstered seats, and plastic armrests. Fabric shall be selected by the Architect from the manufacturer's standard. Fabric shall be nylon, weighing a minimum of 21 ounces per linear yard, with 3M Scotchguard protection.

B. Chairs shall be provided in nominal 21 inch width or as shown on the drawings to achieve layout shown.

C. Chairs shall be able to be attached to adjacent chairs with an integral ganging mechanism. Ganging mechanism shall require no additional or loose hardware or tools for assembly.

D. Provide row letters and seat numbers as determined by the Owner during shop drawing review.

2.4 FABRICS

A. Seat Cushion Upholstery fabric shall be grade 3 or better. Color: Per architect from manufacturer's standard line.

B. Seat fabric material shall meet Class 1 flammability requirements of the U.S. Department of Commerce Commercial Standard 191-53 per Bulletin #117 and to applicable local codes. (Include Bulletin #133 for Boston or California)

C. Seat fabric shall meet wearability criteria – double rub – Wyzenbeek 100,000, heavy duty test.

2.5 PADDING

A. Seat and back padding shall be a minimum of 1" thick at its minimum dimension.

B. Seat and back padding material shall be of new (prime manufacture) closed cell, medium density polyurethane foam. Padding material shall comply with the flammability requirements outlined in the California Technical Information Bulletin #117, Resilient Cellular Materials, Section A & D, dated February 1975, when tested in accordance with Federal Test Method Standard 191, Method 5903.2.

2.6 FINISHES

A. Metal parts shall be free from rust, scale, dirt, and welding spatter. All weldments or other metal components shall receive a coat of corrosion resistant primer prior to finish coating and component assembly.

B. Steel shall be painted with corrosion resistant, low gloss enamel, epoxy or baked on powdercoating. Color: black.

C. Visible aluminum components, including nosings, shall have anodized or powder-coated finish. Color: black.

D. All exposed hardware, including but not limited to bolt and rivet heads shall be black or painted black.

2.7 DESIGN CRITERIA

A. Seating shall be designed to support, in addition to its own weight, and the weight of added accessories, a live load of not less than 250 lbs.

B. American Institute of Steel Construction (AISC), American Iron and Steel Institute (AISI) and Aluminum Association (AA) design criteria shall be the basis for calculation of member sizes and connections.

2.8 FABRICATION

A. Steel supports shall be tubular or channel constructed of formed steel shapes of the size and shape necessary to support the design loads.

B. Wheels shall not be less than 6 inch non-marring soft rubber face to protect wood or synthetic floor surfaces. Each operating row shall have a minimum of 6 wheels.

2.9 ACCESSORIES

A. Transport and storage dollies shall be provided to accommodate the entire inventory of seats.

1. Individual dollies shall have a minimum capacity of 10 and maximum capacity of 20 seats.
2. Dollies shall include casters.

PART 3 – EXECUTION

3.1 COORDINATION

A. The Contractor is responsible for reviewing all drawings, specifications, and field conditions which affect the work in this contract. Notify the Owner whenever field measurements, analysis of the drawings and specifications, or progress of other trades indicates that the work in this contract cannot be completed as specified or as scheduled.

3.2 PROTECTION OF EQUIPMENT

A. Protect the materials in this Section from soiling and damage during all phases of the work, from the time of manufacture to installation.

B. Cover the seats to protect them from dust, paint, and debris as required.

END OF SECTION

DIVISION 21
FIRE SUPPRESSION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pipe, fittings, valves, and connections for sprinkler system.

B. Related Sections:
1. Div. 3/ Section 03 10 00 - Concrete Forming and Accessories: Execution requirements for inserts and sleeves specified by this section.
2. Div. 9/ Section 09 90 00 - Painting and Coating: Execution requirements for piping painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
3. ASME B16.25 - Buttwelding Ends.
4. ASME B16.3 - Malleable Iron Threaded Fittings.
5. ASME B16.4 - Gray Iron Threaded Fittings.
6. ASME B16.5 - Pipe Flanges and Flanged Fittings.
7. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

B. ASTM International:
1. ASTM A47 – Standard Specification for Ferric Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A795 – Standard Specification for Black and Hot-Dipped Zink-Coated (galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
4. AWWA C105 – Polyethylene Encasement for Ductile Iron Pipe Systems.

E. National Fire Protection Association:
1. NFPA 13 - Installation of Sprinkler Systems. 2019 edition
2. NFPA 13R Standard for installation of sprinkler systems in low riser residential occupancy. 2019 edition

3. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances. 2019 edition
4. NFPA 14- Standard for installation of standpipe and hose system 2019 edition
5. NFPA 25- Standard for inspection, testing, and maintenance of water-based fire protection systems 2020 edition

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Product Data: Submit manufacturers' catalogue information. Indicate valve data and ratings.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13 standard.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer: warranty for basic fire suppression materials and methods.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of valve stem packing for each size and type of valve installed.

PART 2 PRODUCTS

2.1 VALVES

A. Manufacturers:
1. Milwaukee.
2. Stockham.
3. Kennedy.
4. Mueller.
5. Victaulic
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Gate Valves:
1. Up to and including 2 inches: bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends. Similar to Stockham Model No. B-133.
2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast-iron wedge, flanged ends. Similar to Stockham Model No. G-634.

C. Globe or Angle Valves:
1. Up to and including 2 inches: bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable Buna n Seat disc, threaded ends, with back seating capacity. Similar to Kennedy Model No. 98-SD. Ball Valves:
2. Up to and including 2 inches: bronze two-piece body, brass, chrome plated bronze, or stainless-steel ball, Teflon seats and stuffing box ring, lever handle, threaded ends. Similar to Kennedy Model No. 775.

D. Butterfly Valves:

1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115-volt AC.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel-plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device, and external tamper switch rated 10 amp at 115-volt AC.

E. Check Valves:
1. Up to and including 2 inches: bronze body and swing disc, rubber seat, threaded ends. Similar to Stockham Model No. B-319Y.
2. Over 2 inches: Iron body, bronze trim, swing check, renewable disc and seat, flanged ends. Similar to Stockham Model No. G-939.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.2 BURIED PIPING

A. Double Iron: AWWA C151.
1. Fittings: AWWA C110, ductile iron standard thickness.
2. Joints: AWWA C111, rubber gasket.
3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.
4. Jackets: AWWA C105, polyethylene jacket for corrosive soils.
5. Mega lug Flange Restrainer fitting or AMES ES-A in-building riser

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135; ASTM A135 UL listed, threaded light wall for mains larger than 2 inches; or ASTM A795; Schedule 40 black, outside applications shall be galvanized pipe. Pipes shall have a corrosion resistance ratio (CRR) of 1.00 or greater per UL listing. Piping shall be black carbon steel, except in FM approved dry systems, where pipe shall be hot-dipped galvanized to meet ASTM A795 zinc coating specifications. Pipe shall be Schedule 40 or equal; for 2 inches and smaller. Threaded joints and fittings. Schedule 10 for pipes size 2-1/2 inches or larger. Victaulic or grooved fittings may be used.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; or ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges, and flanged fittings; or ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings, or ASTM A47.

2.4 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13/NFPA 13R.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 24 for service mains.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Pipe through floors, wall, and ceilings, at head locations, shall be equipped with approved sleeves and escutcheons. Escutcheons shall be polished chrome plated.

F. Install pipe sleeve at piping penetrations through footings, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers to with minimum 1/2-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
7. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 90 00.

K. Do not penetrate building structural members unless indicated.

L. Where more than one piping system material is specified; Install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil, or other non-toxic joint compound applied to male threads only.

N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

O. Install gate or butterfly valves for shut-off or isolating service.

P. Install drain valves at main shut-off valves, low points of piping and apparatus.

Q. Sprinkler system shall be provided with complete drainage facilities in accordance with UBC Std drain discharge shall not spill on grade. It shall go into a sewer.

R. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

S. Upon completion and prior to acceptance of installation, Contractor shall subject system, including underground supply connections, to tests required by CBC Std and shall furnish CFC with a certificate of compliance as required.

T. Close nipples shall not be used. Threaded unions shall not be installed in concealed areas unless provided with an approved access panel.

U. Fire sprinkler systems piping hanger and supports shall conform to the UBC Std requirements.

V. Underground pipe shall be laid on a flat undisturbed sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick, prior to backfilling.

W. Piping to a sprinkler head in the elevator machine room or elevator shaft shall not go out of the room or shaft.

X. Provide shunt trip on sprinklers located in the elevator machine rooms and elevator hoist way unless the sprinklers are located 2 feet or less from the pit floor**.**

3.3 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 CLEANING

A. Div. 01/ Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean entire system after other construction is complete.

END OF SECTION 21 05 00

SECTION 21 13 13 - FIRE-SUPPRESSION SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire sprinkler system for the protection of buildings.

C. Related Requirements: The requirements of this Section, NFPA 13 and NFPA 14 shall take precedence over requirements found in the following:

1. Division 01 - General Requirements.

2. Section 07 84 13: Penetration Fireproofing.

3. Section 22 05 00: Plumbing Common Work.

4. Section 31 23 23: Excavation and Fill for Utilities.

5. Section 33 11 00: Site Water Distribution Utilities.

1.02 SUBMITTALS

A. Manufacturer’s Data:

1. Submit complete and detailed equipment and material list of items to be furnished and installed under this section.

2. Submit manufacturer's specifications and other data required to demonstrate compliance the plans and specified requirements.

B. Drawings:

1. Submit shop drawings of wet pipe fire protection sprinkler system in compliance to NFPA 13, Standard for the Installation of Sprinkler Systems, Sprinkler systems shall comply with the provisions of NFPA 13.

2. Shop drawings shall fully comply with the most stringent provisions of this specification and plans, and with the applicable codes and standards.

3. Shop drawings shall be the same size as the Contract Drawings and shall be produced using AutoCAD.

C. Regulatory Requirements:

1. Installation of fire sprinkler system shall not vary from the plans unless alterations have been approved by the State Fire Marshal at DSA.

2. Complete DSA standard testing forms and get sign-off by the Project Inspector.

D. Closeout Submittals: Submit in accordance to Section 01 77 00, Contract Closeout, and as specified herein:

1. Record Drawings:

a. Record drawings of installed Work shall be maintained current on the Project site, available for Fire Marshal and the Project Inspector to review.

b. At the completion of installation submit Record Drawings signed by installing Contractor in AutoCad format, including:

1). Record Specifications.

2). Record Product Data: Include specific model, type and size for equipment and material installed.

3. Record Test Results.

4. Maintenance Manuals.

1.03 QUALITY ASSURANCE

A. Comply with applicable national or local codes and standards.

B. Except where exceeded by the requirements of these specifications, the following are made part of this section: prints and details, and provisions of the NFPA 13 Standard for Installation of Sprinkler Systems Standard for the Installation

C. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a 5-year history of successful products that is acceptable to the Architect.

D. Qualifications of Installer: Installer shall have a current C-16 license in the State of California in the installation of fire sprinkler systems.

1.04 FIRE SERVICE WATER CONNECTION

A. Fire Service Mains shall be provided with approved Meter Service Backflow protection. An approved Reduced Pressure Principal Backflow Prevention Assembly (RP) to meet minimum backflow protection requirements for meter service protection (MSP) shall be provided on the fire main, according to the California Plumbing Code (CPC) and according to the current City of Compton Requirements.

1.05 PRODUCT HANDLING

A. Comply with the provisions specified in Sections 22 05 00 and 22 05 13.

1.06 COORDINATION

A. Coordinate activities in accordance with provisions of Section 22 05 00.

1.07 JOB CONDITIONS

A. Unscheduled utility flow interruptions are not permitted. Schedule service interruptions in advance, with the OAR.

1.08 EXTRA MATERIALS FOR MAINTENANCE

A. Provide spare sprinkler heads in a quantity equal to 2 percent of the total number of each type of sprinkler head installed. There shall be no less than two heads of each type and temperature rating provided and in no case less than six spare sprinkler heads per building. There shall be no fewer than 6 spare sprinkler heads for up to 300 sprinkler heads installed; no less than 12 spare sprinkler heads for up to 1,000 sprinkler heads installed, and no less than 24 spare sprinkler heads for the sites with more than 1,000 sprinkler heads installed. Spare sprinkler heads shall be kept inside of spare sprinkler head box(s). A spare sprinkler wrench for each type of sprinkler head shall also be provided inside of each spare sprinkler head box, at each building. Locations of spare sprinkler boxes shall be located at:

1. Fire Sprinkler Riser, when enclosed and secure.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SYSTEM DESCRIPTION

A. General: Provide systems complete including, but not limited to:

1. Provide underground and above-ground sprinkler and standpipe piping including trenching and backfilling. Materials and equipment shall be UL/FM listed and approved as required by NFPA for their application. Required signage shall be provided and installed as required by NFPA 13.

2. Provide overhead sprinkler system with sprinklers installed as required according to type, location, and temperature rating.

B. Sprinkler Heads:

1. Provide chrome pendant spray-type sprinkler heads with matching escutcheons in areas with finished ceilings. Exterior escutcheons shall be poly-coated or concealed type to prevent rusting and oxidation.

2. Provide upright sprinklers in areas with exposed piping.

3. Provide poly-coated glass bulb corrosion resistance type sprinklers heads in areas exposed to a corrosive environment such as parking garages and coastal air.

4. Sprinklers shall be glass bulb type, with hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation,

5. Sprinklers in concealed spaces, exterior locations, and other areas that will experience over 100 degrees F ambient temperature shall be furnished with 200-to-225-degree rated sprinklers. Sprinkler heads in boiler rooms, furnace rooms, or heater rooms shall be furnished with sprinklers rated at 250 to 290 degrees F. If a sprinkler is directly affected by a spotlight, steam, or another heat source, a 350-degree F or higher sprinkler head shall be furnished. Sprinkler heads in other locations, unless otherwise noted, shall be 155 to 165 degrees F rated.

6. Automatic fire sprinkler head type shall be as follows:

   a. In areas with ceiling heights of nine feet or lower, sprinkler heads installed shall be recessed or fully concealed.

   b. Ceilings eight feet or lower shall be provided with fully concealed sprinkler heads.

   c. Areas with a ceiling height of nine feet or lower, that are not constantly supervised such as corridors, arcades, students' restrooms, and other restrooms shall be provided with fully concealed sprinkler heads.

7. Sprinkler heads in light hazard occupancies are required to be Quick Response sprinklers as required in NFPA 13. Sprinkler heads shall be of the same manufacturer throughout the building/site as indicated. Sprinklers shall typically be ½ inches NPT, standard orifice, minimum 5.6 nominal K factor, UL listed for 175 psi, and listed for light and ordinary hazard occupancies.

8. Other specialized sprinkler heads such as a walk-in refrigerator or freezer heads, side wall, ¾ inches sprinklers above 5.6 K factor, and those sprinklers with a K factor below 5.6, shall only be used where required by project condition. Large drop sprinkler heads and extended coverage sprinkler heads shall not be installed.

9. Sprinkler head location shall be designed and installed in an aesthetically pleasing manner and should generally be located in the center of 24-inch by 24-inch ceiling tiles and in the center of 24-inch by 48-inch ceiling tiles in the 24-inch direction and no closer than 12-inch from the edge in the 48-inch direction.

10. UL/FM listed Sprinkler head guards shall be provided on Sprinkler heads installed at seven feet six inches above the floor or lower in exposed locations, or that are deemed subject to damage. Sprinkler head guards shall securely fasten with a bolt-on feature to the base of the sprinkler or be a factory-installed guard. Guards shall also be provided on upright and sidewall heads where sprinklers are installed at seven feet six-inch heights or lower.

C. Fire Sprinkler and Standpipe Systems:

1. Underground piping: Comply with the requirements of Section 33 1100, Site Water Distribution Utilities.

2. Provide an underground UL/FM listed PVC or Ductile iron supply line connected to detector check meter or water main as indicated. Install site water mains no closer than 10'- 0" parallel to the building foundations. Underground fire water lines shall be installed 36 inches below grade. Tracer wire shall be installed in accordance with Section 33 1100: Site Water Distribution Utilities.

3. Fire Department Connection (FDC) with check valve (wafer type) shall be provided after the backflow preventer, and before the building fire sprinkler riser(s), located where the FDC will be accessible to the fire department from the street or sidewalk without obstructions. No shut-off valve shall be allowed on the FDC line as per NFPA 13. FDCs shall have a height between two and four-foot above the ground.

4. PIVs shall be electrically supervised regardless of the number of fire sprinklers served (CBC 903.4), and set at a height of three feet to the top and have the handle locked in place with a break-a-way lock.

5. Provide a UL listed, FM approved FDC, approved RP type backflow assembly, check valves, shut-off valves, drain valves, ITV, and flow indicator at the locations required. (Test-and-drain combination valves are prohibited.)

6. Flow indicator shall activate the fire alarm system between 45 and 90 seconds, and activate a local alarm on the outside of the building continuously with water flow. The connection of this switch is a part of the Work of Division 26. Shut-off including valves on the fire main backflow preventer shall be electrically supervised according to CBC 903.4, NFPA 13, and Section 28 3100 – "Fire Detection and Alarm".

7. Pipe through ceilings at head locations shall be furnished with a two-piece or fully concealed escutcheon. Unless otherwise designated, escutcheons shall be identical and match the other escutcheons of the same type throughout the building or site. Piping through walls and ceilings shall have a split ring chrome escutcheon.

   a. Flexible stainless steel sprinkler head drop system may be used. Flexible drops shall be UL listed, FM approved and shall be compatible with ceiling systems. Flexible drop length shall be included in the Hydraulic Calculations. The drop system shall include the required support bracing.

8. Furnish and install required signs, spare heads, special wrenches, and spare sprinkler head boxes as required to satisfy NFPA 13, NFPA 14, and this specification.

9. Sprinkler system piping shall be provided with complete drainage as required by NFPA. Test valve discharge shall be piped away from planters to asphalt areas. Furnish protection of piping against accidental or malicious damage.

10. Upon completion of the Work of this section, and before Substantial Completion, subject system, including underground supply connection, to tests required. A

minimum hydrostatic test shall be two hundred pounds (200 psi) or fifty pounds (50 psi) in excess of the maximum system working pressure, whichever is greater, for two hours with no leaks or loss of pressure per NFPA 13. The Project Inspector shall be furnished with an NFPA 13 test certification.

11. Local fire sprinkler alarm requirements shall be accomplished with a vane or paddle type water flow detector switch and an electrically powered fire sprinkler horn located on the street side of the building and connected to the fire alarm control panel with secondary power provided from the fire alarm batteries. The drilled-out disk shall be attached to the mounting U-bolt. Time delay shall be set at 45 to 60 seconds. Mechanically activated water bells with alarm valves and pressure switches are prohibited.

12. Seismic separation assemblies shall be located between the buildings if space allows accessibility. Otherwise they shall be located inside the building providing the most space. Swing joints may be fabricated on site using flexible groove couplings and six grooved (Victaulic) 90 degree elbows in a teepee formation (see NFPA 13, figure A.9.3.3). Seismic separation assemblies can also be made utilizing a manufactured, UL/FM listed swing joint assembly rated at a minimum 175 psi.

13. Hanging, bracing and support shall utilize only UL/FM listed approved products, and comply with NFPA 13, Chapter 9 requirements for rod and bolt sizes except for the following: 4 and 6 inch pipe shall be supported by a minimum ½ inch hanger rod, 8 inch pipe shall be supported by a minimum 5/8 inch hanger rod, 10 and 12-inch pipe shall be supported by a minimum ¾ inch hanger rod. Hanger rods in exterior locations and in parking structures shall have Electrodeposited Zinc Coating per ASTM B633 to prevent rusting.

14. Building Fire Sprinkler riser assemblies shall be provided as follows. Every building shall be provided with an accessible and electrically supervised riser shut-off valve at a height not to exceed five feet above the floor. Every building riser assembly shall be equipped with a check valve followed by the main drain valve and then the flow indicating switch and pressure gauge immediately after the shut-off valve. In cases where a riser assembly is provided for each floor in the building, a check valve, main drain and flow switch shall be provided for each floor; the main building shut-off shall not be required. An electrically supervised Post Indicator Valve located outside the building may serve as the building riser shut-off valve.

2.02 MATERIALS

A. Access Panel:

FAP-1 Square, steel, prime-coated, with vandal-proof door lock operated by Allen wrench:

Smith	Josam	Elmdor
4760		DW – AKL

B. Globe or Angle Valves: UL/FM listed.

AV-1 Bronze angle valve: 2 inches and smaller, screwed-in bonnet, threaded ends, rising stem:

Nibco	Kennedy	Fairbanks	United
T-301	98 SD	0210	126T

C. Automatic Fire Sprinkler Head, UL/FM listed:

AFSH-1 Brass pendant type for areas with suspended ceilings:

Victaulic	Tyco	Viking	Reliable
V27	TY 3231	VK302	F1FR56

AFSH-2 Brass upright type for areas with no ceilings:

Victaulic	Tyco	Viking	Reliable
V27	TY3131	VK300	F1FR300

AFSH-3 Chrome or poly coated semi-recessed type with semi-recessed escutcheon:

Victaulic	Tyco	Viking	Reliable
V27	TY3231	VK302	F1FR56

AFSH-4 Fully concealed type sprinklers; chrome cover:

Victaulic	Tyco	Viking	Reliable
V38	TY3531	VK462	F4FR
		VK404	G4A

D. Backflow Prevention Assemblies:

BPV-1 Reduced Pressure Principal Backflow Prevention Assembly (RP) type for meter service protection (MSP) requirements:

Ames	Febco	Watts	Wilkins
4000SS	860 OS&Y	909 RP	975 RP
C400	880 OS&Y	957 RP	375 RP
M400		994 RP	

E. Gear Operated Butterfly Valves:

GOBFV-1 Grooved end Gear Operated Butterfly Valve, 300 psi, for fire protection sprinkler risers. UL listed, FM approved, with weatherproof gearbox and double pole/double throw monitor switch, double seal design for bubble tight shut off at 175 psi. Corrosion-resistant, fusion-bonded nylon II body coating, easy-to-read position indicator:

Kennedy	Nibco	Victaulic	Tyco
Figure 82M	GD-4765-8N,	705W	580
	300 psi	300 psi	300 psi

GOBFV-2 Wafer Type Gear Operated. Butterfly Valve, same requirements as GOBFV-1:

Kennedy	Nibco
Figure 82W	WD-3510
	300 psi

F. Check Valves:

CV-1 Bronze check valves: 2 inches and smaller, 200 psi WOG, bronze disc, swing type, conforming to MSS-SP-80-97, threaded ends:

Crane	Nibco	Stockham	United
37	T-433-Y	B-319	62T

CV-2 Iron check valves: 2-1/2 inches and larger, class 175, composition disc, swing type, bolted cap, UL listed, FM approved flanged ends:

Stockham	Kennedy	Tyco	Clow
G-940	126	Model G	F5380

CV-3 Wafer Type Check Valve:

United Wafer Check #90	Nibco KW-900-W	Mueller A-2102

CV-4 Grooved Check valve 2 ½ inch and larger:

United	Gruvlock	Reliable	Victaulic	Tyco
67	7800	Mode “G”	Series 717	590F

G. Escutcheons

ES-1 Chrome plated, or white poly-coated, 2-piece canopy (escutcheon), 2.25 to 3.5 inches in extended position:

FPPI	Tyco	Reliable
01 - 401	No. 401	HBC (chrome)
Chrome or	Chrome or	HBW (white)
White	White	

ES-2 Chrome plated or white poly coated; 2-piece recessed:

FPPI	Tyco	Reliable (semi-recessed)
01 - 400	410	GF2-C (chrome)
01 - 402	420	GF2-W (white)

H. Fire Department Connections:

FDC-1 UL listed, FM approved, type, 4 inches by 2-1/2 inches by 2-1/2 inches bronze body fire department hose connection (FDC):

Crocker 6405 or 6420	Potter-Roemer 5710 or 5730	Tyco 86	Powhaten 21-201 or 31-133

I. Flow Indicators:

FIA-1 Listed by State Fire Marshal, with a double pole, double-throw switch, one normally open and one normally closed, UL listed and FM approved:

Potter-Roemer VSRF Series	Notifier WFR Series

J. Outside Stem and Yoke Gate Valves:

OS&Y-1 Bronze Gate Valves: 2 inches and smaller, class 175, solid bronze wedge disc, OS&Y, copper silicon alloy stem, UL/FM listed, threaded ends:

Stockham B-133	Crane 459	Nibco T-14	United 18

OS&Y-2 Iron gate valves: 2 ½-inch and larger, class 175, IBBM, OS&Y, solid wedge disc, Teflon-impregnated packing, UL/FM listed, flanged ends:

Stockham G-634	Crane 467	Kennedy 68	Mueller A-2073	Victaulic 771

OS&Y-3 2 ½-inch and larger, epoxy coated, resilient wedge, 175 pounds gate valve for riser valves, P.I.V., and shut off:

Clow F-6136	Nibco 617-0	Kennedy KV-4068	Mueller A-2360

K. Gate Valves:

GV-1 Bronze gate valves: 2-inch and smaller, class 175, solid bronze wedge disc, rising stem copper silicon alloy stem, UL/FM listed, threaded ends:

Stockham B-133	Crane 459 Fig. 66	Grinnell 14	United

GV-2 Iron gate valves: 2 ½-inch and larger, class 175, IBBM, solid wedge disc, Teflon impregnated packing, UL/FM listed, flanged ends:

Stockham G-634	Crane 467	Kennedy 68	Mueller Victaulic A-2052 772

L Gear Operated Ball Valves:

GOBV-1 Threaded ball valve for sizes two inches and smaller:

Nibco KT-505W-4 Victaulic 728

M. Seismic Swing Joints:

SJ-1 UL/FM Approved flexible seismic connector with grooved, or threaded ends for seismic separation requirements.

SJ-2 Fabricated swing joints as per NFPA 13 using six grooves 90-degree elbows and flexible groove couplers such as Victaulic style 75.

N. Post Indicator Valves:

PIV-1 Vertical Indicator Posts: Furnished for underground valves, post must provide a means of knowing if the valve is open or shut, UL/FM listed. (Where a backflow assembly is provided, the shutoff valves on the backflow preventer satisfy the requirement for a post indicator valve to control the fire main and FD Connection):

Stockham	Kennedy	Grinnell
G-951	2945	F-750
Clow	Mueller	Victaulic
F-576	2945	774

PIV-2 Posts Indicator valve: Furnished for underground valves. Ductile iron fusion bonded epoxy coated resilient wedge gate valves: 4 inches and larger, class 175 lb, non-rising stem, mounting plate for indicator post, UL/FM listed, flanged or mechanical ends (in accordance with NSF 61).

Stockham	Kennedy	Clow	Mueller	Victaulic
G-635	71X	F-6100	2360	772

O. Sprinkler Guards:

SPG-1 Sprinklers installed at seven feet six inches above the floor or lower in exposed locations, or that are deemed subject to damage shall be equipped with a UL/FM listed, head guard. Guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer. Sprinkler head guards shall securely fasten with a bolt-on feature to the base of the sprinkler or be a factory-installed guard. Guards shall also be provided on upright and sidewall heads where sprinklers are installed at seven feet six-inch heights or lower.

Reliable	Viking	Tyco	FPPI	Victaulic

P. Sprinkler Horn:

SPH-1 UL/FM approved, surface-mounted, weatherproof and red finished:

Horn:	Bell:
HRK System Sensor	SSM-24-10 System Sensor
24 V-DC	24 V-DC
Weatherproof with	Weatherproof with
BBS-2 back-box for	WBB box for
Surface mount	Surface mount installation

Q. Hangers, Supports, Bracing:

HSB-1 Tolco products or UL listed and FM

R. Threaded fittings:

TF-1 Ductile iron, 300 psi rated, UL listed, FM or NFPA approved.

TF-2 Cast iron fittings, 175 psi rated, UL listed, FM or NFPA approved:

Anvil Ward Taylor

TF-3 Malleable Iron, 300 psi rated, UL, Listed, FM or NFPA approved

TF-4 Galvanized, 175 psi rated, UL Listed, FM or NFPA approved

S. Fire Sprinkler Pipes and Standpipes:

FSP-1 Fire sprinkler pipe: 1 inch through 8-inch, Schedule 40, black or galvanized steel meeting ASTM Standards A53, A135, or A795. Pipe Corrosion Resistance Ratio (CRR) shall be 1.00 or greater. Pipe may be threaded or grooved.

a. Piping 2 inches and smaller shall have threaded joints and fittings in concealed, non-accessible locations. Groove coupler connections (Victaulic, Viking VGS) on pipe sizes 1 inch through 2 inches are acceptable in accessible areas with required seismic bracing provided. Plain end connections such as “Plainlock” and “FIT” are prohibited.

b. For pipe sizes 2 ½-inch and larger, grooved type (Victaulic, Viking VGS), welded, threaded and flanged connections may be used. Any connection that does not utilize a threaded, welded or grooved

connection is prohibited, except for mechanical tee bolt-on branch outlet fittings sizes 2-inch and smaller (Victaulic 920 and the 920N).

c. Submit Verification from the manufacturer stating that piping material furnished meets the above criteria; (i.e.: threadable pipe has a UL assigned CRR of 1.00 minimum, that it meets ASTM A53, A135, or A795, and it is UL listed, FM or NFPA approved.)

FSP-2 Ductile iron pipe, AWWA C151 (for pipes below grade). Gasketed self-retaining joints per ASME/ANSI B16.4.

FSP-3 Plastic, PVC, thick wall (cast iron OD sized), DR 14 (200 PSI). UL listed for fire main service (underground). Gasketed self-retaining joints - Johns Manville Blue Brute AWWA C900, JM Eagle C900 water pipe.

FSP-4 Fire Sprinkler Pipe: 1 inch through 3-inch, Copper meeting NFPA 13 Standards. The pipe may be grooved.

FSP-5 Flexible Fire Sprinkler Head Connectors: 1-inch pipe size flexible stainless steel fire sprinkler head connectors “Flex Head Industries” Models 2024, 2036, 2048, 2060, and 2072.

2.03 ACCESSORIES AND APPURTENANCES

A. Escutcheons: Polished chrome plated split-ring type for exposed piping at every penetration inside finished rooms.

B. Guards: Provide sprinklers with guards at the ceiling at or under seven feet six-inch high and were subject to damage or vandalism.

C. Miscellaneous: Provide accessories and appurtenances for a complete system.

2.04 FIRE HOSE VALVES (Not Applicable).

A. Schedule Numbers:

SPV-1 Valve, Fire Hose, cast brass angle valve, UL listed and Factory Mutual approved; 1 ½-inch at 175 psi, female NPT outlet with 1 ½-inch male NPT by 1 ½-inch male NST adapter nipple.

POTTER-ROEMER	POWHATAN	UNITED
4070	500	88

SPV-2 Valve, Standpipe for 2 ½-inch for 150 or higher psig working pressure, male NST outlet for fire department hose connection. Cast brass, replaceable composition disc, and rough chromium-plated body (unless provided inside UL listed valve cabinet) with hand wheel.

POWHATAN	UNITED	POTTER-ROEMER
DXWDGV-250F DXAV5-250F	88H	4065

2.05 STANDPIPE VALVE CABINETS (Not Applicable).

A. Schedule Numbers:

SPVC-2 Surface-mounted cabinet for masonry walls, same as SPVC-1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe ends.

B. Remove scale and foreign matter, from inside and outside of pipes, before assembly.

C. Provide piping connections to equipment with flanged or grooved connections.

3.03 INSTALLATION

A. Install underground supply line connected to detector check or water main indicated. Braced or clamped bends shall be in accordance with the requirements of NFPA 24. Provide vertical clamp rods at flange and spigot piece of risers, long enough to pass through riser's base flange where required. Furnish concrete thrust blocks where required. Tracer wire shall be installed as per Section 22 0553: Plumbing Identification on PVC underground piping.

B. Install FDCs, check valves, shut-off valves, gauges, Inspector’s test, and drain assemblies, and flow indicator. FDC must be installed so that it is unobstructed and accessible for the Fire Department’s first response unit.

C. Pipe through floors, walls, and ceilings, at head locations, shall be furnished with required sleeves, escutcheons, and fire caulking where indicated and/or required by code. Escutcheons shall be polished chrome plated unless another finish is selected by the Architect.

D. Sprinkler system shall be provided with complete drainage facilities in accordance with CBC standards. Drain discharge may discharge into a sewer, storm drain, sump pit or street gutter. Fire sprinkler drains shall not discharge onto a playground or across a sidewalk. Discharge to plumbing fixtures is prohibited due to the inability of a plumbing fixture to receive a full flow of water from a fire sprinkler drain valve under working pressure.

E. Upon completion of the Work of this section, and before Substantial Completion, subject the entire system, including underground supply connections, to tests as required by NFPA 13, and CBC standards and furnish the Owner with a certificate of compliance as required.

F. Close nipples are prohibited. Threaded unions are prohibited. Where a threaded union or coupling is needed, a groove type fitting (Victaulic) shall be used instead. If a groove style coupling is used in a concealed area, an access panel allowing full access to that connection shall be provided.

G. Fire sprinkler systems piping hangers, seismic bracing, anchors, and supports shall conform to NFPA 13, CBC, and other applicable codes and the requirements of this specification.

H. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer.

I. Tee branch outlets on fire sprinkler mains shall be by the use of a threaded ductile iron tee fitting, a groove type tee fitting, (Victaulic), or by the use of a thread-a-let welded on by a certified welder as required by NFPA. Mechanical tee bolted branch outlet fittings are prohibited except for branch outlet sizes 2-inch and smaller.

J. Sprinkler lines within the building shall be concealed within the structure. Risers shall be installed in utility, supply rooms, or similar service areas whenever possible, and shall not obstruct access, or maintenance of other equipment within the space. Mains and risers shall be located within the area protected by the sprinkler system unless otherwise approved by fire authorities having jurisdiction.

K. Sprinklers that have been dropped, damaged, have cracked bulbs, or show a visible loss of fluid shall not be installed.

L. Sprinkler bulb protectors shall be removed by hand after sprinkler installation. Tools or other devices to remove the protector that could damage the bulb in any way shall not be used.

M. Routing of piping in non-concealed exposed areas shall be subject to the Architect's review in the final shop drawings.

N. Underground piping shall have a minimum of 36 inches of cover to grade. Underground pipe shall be installed on a flat not less than the 6-inch-thick undisturbed sand bed. After the required pressure-leak test, the pipe shall be covered with sand not less than 6 inches thick, before backfilling. Comply with NFPA Standards. Piping is not allowed to be underground below the building floor slab.

O. Provide approved backflow prevention assemblies. Installations of backflow prevention assemblies shall be tested and certified by a certified Los Angeles County backflow prevention device tester prior to Substantial Completion. Tests shall be performed in the presence of the Project Inspector. Test reports shall be turned over to the Project Inspector for mailing to the proper agency.

P. Provide shunt trip when sprinklers are installed in the elevator machine rooms and elevator hoistway unless the sprinklers are located 2 feet or less from the hoistway pit floor.

Q. Test valve (ITV) shall be located at the opposite end of the sprinkler system from the supply. Test-and-drain type combination valves are prohibited. ITV discharge and main drain lines shall be piped to a sump pit or to the outside of the building to within a foot of the ground where it will drain away from the building to an exterior storm drain.

R. Each building with a sprinkler riser shall be furnished with an accessible shut-off riser valve installed no higher than five feet from the finish floor. Each floor shall have a separate shut-off valve with a flow switch, and shall be securely enclosed or secured with a chain and break-a-way lock. Also, see section 2.01- C-12 of this specification.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose at the off-project site.

END OF SECTION

DIVISION 22
PLUMBING

SECTION 22 05 00 - PLUMBING COMMON WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section provides the basic plumbing requirements that apply to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.
2. Division 22: Plumbing
3. Division 23: Mechanical
4. Division 26: Electrical.

1.02 REGULATORY REQUIREMENTS

A. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.

1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.
2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.
    a. Test samples for lead content by the atomic absorption spectrophotometry method.
3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.
4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. ANSI - American National Standards Institute.

2. ASME - American Society of Mechanical Engineers.
   a. ASME Boiler and Pressure Vessel Code.
   b. ASME B31 - Standards for Pressure Piping.
3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
4. ASTM - American Society for Testing and Materials.
   a. ASTM A53 Specification for Welded and Seamless Pipe.
5. AWWA - American Water Works Association.
6. CSA - Canadian Standards Association.
7. FM Global - Factory Mutual Global
8. IAPMO - International Association of Plumbing and Mechanical Officials.
9. NFPA - National Fire Protection Association.
10. OSHA - Occupational Safety and Health Administration.
11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
12. UL - Underwriters Laboratories Inc.
13. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:
   1. CBC, California Building Code, and CMC, California Plumbing Code.
      a. Latest edition as adopted by the City of Compton, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.
   3. OSHA - Occupational Safety and Health Administration.
   4. CDPH - California Department of Public Health.
   5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 3300: Submittal Procedures and with specific requirements of Division 22 sections, as applicable.

B. The above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 31 13: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 31 13 and Section 01 33 00 and shall indicate at a minimum:

1. Complete system layout of equipment, components, plumbing fixtures, piping, indicating service clearances, and pipe sizes, fitting types and sizes and pipe elevations, distances of pipes and equipment from building reference points and hanger support locations. The above items shall be coordinated on the shop drawings according to the requirements of Section 01 31 13.

2. Schedule and description of equipment, piping and fittings.

1.04 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 77 00: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of plumbing and fire protection drawings in AutoCAD and BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and 3 sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit two copies of operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return three copies of manuals. Manuals shall be bound in accordance to Section 01 77 00. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

1) Identification of components and controls.

2) Trouble shooting checklist and guidelines.

3) Recommendations for optimum performance.

4) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 22 that includes the following as a minimum:

1) Manufacturer's model, identification and serial numbers.

2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

3) Directory of manufacturer's representatives, service contractors and part distributors.

4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of plumbing, fire protection and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 23 0593.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.05 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.07 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.08 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:

1. A minimum of 4 hours of on-site overview of the overall Plumbing System.

2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.09 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. The additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

D. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.01 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.02 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes pass through, or are located within one inch of any construction element, install a resilient pad, ½ inch thick minimum, to prevent contact.

C. Furnish provisions for recesses, chases, and accesses and provide blocking and backing for proper reception and installation of plumbing Work.

3.03 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment indicated on the Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.04 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 22, including this Section.

B. Additional tests may be required in the case of products, materials, and equipment if:

1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

C. Piping Tests:

1. Perform tests required to demonstrate that operation of plumbing systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.

2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.

3. Pressure gauges furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.

4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.

6. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Inspector.

7. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

D. Pipe Testing Schedule:

System Tested	**Test Pressure (psig)**	**Test With:**
Cast-iron soil, waste, vent, storm drain, condensate drain from air conditioning equipment	10 feet of water, vertically	
Domestic water piping	200	Water
Gas piping (steel threaded or plastic)	60 (both tests)	Air
Gas piping (steel welded)	100 (both tests)	Air
Gas welding station	1-1/2 Working pressure 100 min.	Dry nitrogen

E. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.

2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.

3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of all equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified capacities.

4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

   a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.

6. Provide electric energy and fuel required for tests.

7. Final adjustment to equipment or systems shall meet specified performance requirements.

8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

F. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, plumbing equipment and systems shall be operated and tested as indicated in Article 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 22 05 13: Plumbing Basic Materials and Methods.

3.05 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by plumbing systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.06 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 50 00: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pumps, compressors and similar equipment.

5. Interior of piping shall be maintained free of dirt, grit, dust, and other foreign materials.

6. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

7. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas.

END OF SECTION

SECTION 22 05 13 - PLUMBING MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing.

3. Division 23: Mechanical.

4. Division 26: Electrical.

1.02 SUBMITTALS

A. Provide in accordance with Division 01, Section 22 05 00 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.03 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Conform to provisions of Section 22 05 00: Plumbing Common Work

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

D. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the ARCHITECT.

1.04 COORDINATION

A. Coordinate related Work in accordance with provisions of Section 01 31 13: Project Coordination.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in Section 22 05 00, manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.02 MANUFACTURERS AND MATERIALS

A. Ball Valves: 2-inch and smaller:

BV-1: Class 150, 600 psi, Bronze, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: Apollo Valves 77CLF-100A/77CLF-200A, NIBCO T-685-66-LF/S-685-66-LF, Hammond UP8303A/UP8513, Milwaukee UPBA400S/ UPBA450S

BV-2: Class 150, 600 psi, Stainless Steel, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded or solder ends.

Manufacturer: Apollo Valves 76F-100, NIBCO T-585-S6-R-66-LL, Milwaukee BA260.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. Apollo Valves Therma-Seal, NIBCO Nib-Seal Handle.

B. Butterfly Valves:

BFV-1 Centerline Series A, 200 psi CWP tight shut-off.

1. Body: Lug type ductile iron. Suitable for bi-directional dead-end service at rated pressure without use of downstream flange.

2. Disc: Bronze, or aluminum bronze.

3. Stem: One or two-piece, 400 series stainless steel.

4. Seat and O-Rings: EPDM.

5. Upper and Lower Stem Bearings: Copper alloy or non-metallic material.

6. Operators: Valves 6 inches and smaller, with lever handle. Valves 8 inches and larger, with manual gear operator and disc position indicator.

7. Manufacturers:

   a) Valves 2.5 to 6-inch: Apollo Valves LD141, Milwaukee ML 233E, Hammond 6411-03

   b) Valves 8-inch and larger: Apollo Valves LD141, Milwaukee ML 333E, Hammond 6411-03, NIBCO LD 2000

C. Check Valves:

1. Bronze, 2-inch and smaller:

   CHV-1: 200 psi, CWP horizontal swing, Y pattern, renewable seat and disc, threaded ends.

   Manufacturer: Apollo Valves 163T-LF, NIBCO T-413-Y-LF, Milwaukee UP-509, Hammond UP-904

   CHV-2: 200 psi, CWP, bronze body, horizontal swing, Y pattern, renewable seat and disc, solder ends.

   Manufacturer: Apollo Valves 163S-LF, NIBCO S-413-Y-LF, Hammond Up-943

2. Cast Iron 2 1/2-inch and larger:

   CHV-3: Class 125, 200 psi, CWP, IBBM, renewable seat and disc, bolted cap, flanged:

   Manufacturer: Apollo Valves 910F, Crane 372, Stockham G-927, NIBCO T-918-B.

D. Earthquake Valve:

EQV-1: Mechanically triggered by seismic movement, complying with state of California seismic response specifications, UL listed and certified by D.S.A. Size and pressure as required or indicated on Drawings. (Minimum 1/4 psi, maximum 10 psi. Earthquake valve shall shut off gas automatically during an earthquake to prevent an explosion or fire. Acceptable Manufacturers: California Valve (former Koso).

1. Not sensitive to vibrations caused by passing trucks or accidental bumping.

2. Sensitive to wide amplitude G's only. Preset at factory for the correct G-rating.

3. Positive sealing from minus 10 degrees F. to 150 degrees F.

4. Visual open-close indicator.

5. Manual reset.

6. Plumb line for mounting.

7. Tripping mechanism has non-creeping rolling latch.

8. Install valve per manufacturer’s recommendations only.

E. Expansion Tank:

ET-1: Pressurized, vertical, steel expansion tank for potable water systems with FDA approved, replaceable, heavy duty, butyl rubber blend diaphragm, polypropylene lined dome, 1/2 inch, 3/4 inch, 1 inch or 1 ½-inch NPT system connection, 1/2 inch or 3/4 inch drain, 0.302 inch-32 standard automobile tire valve type charging connection, lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VII of the ASME Boiler and Pressure Vessel Code and stamped for 125 psi working pressure. The tank must be also rated for a continuous working temperature of 240 degrees F. Provide weather and rust resistant coating.

Manufacturer: Apollo Valves 16XT, Bell and Gossett, Wheatley, Taco, Amtrol

F. Flow Control Valve – Manual:

FC-1: Flow control valves: Bell and Gossett Series CB circuit setter balancing valve, line size, with integral pointer (to register degree of valve opening), differential pressure meter connections with built-in check valves and lockable memory stops. Manufacturer: Apollo Valves 58A, Armstrong ARMFLO circuit-balancing valves, series CBV

G. Gate Valves:

1. Bronze, 2-inch and smaller:

GV-1: Class 125, 200 psi, CWP, bronze body and bonnet, non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

Manufacturer: Apollo Valves 101T-LF, NIBCO T-113-LF, Milwaukee UP105-P2, Hammond UP645

GV-2: Same as GV-1, except solder ends:

Manufacturer: Apollo Valves 101S-LF, NIBCO S-113-LF, Milwaukee UP115, Hammond UP647.

2. Iron, 2-1/2-inch and larger:

GV-3: Class 125 250 psi CWP iron body, flanged ends, bolted bonnet with wheel handle, resilient wedge, non-rising stem.

Manufacturer: Apollo Valves 610F-LFA, NIBCO F-619-RW.

GV-4: Class 125, 250 psi CWP iron body, flanged ends, bolted bonnet with 2-inch operating nut, resilient wedge, non-rising stem, fusion bonded epoxy coated. For below grade use..

Manufacturer: NIBCO F-619-RW-SON.

H. Heater Vent Pipe:

1. Schedule Number:

HVP-1 For use in intake and exhaust of high efficiency condensing type gas water heaters only as required by manufacturer. Pipe shall be PVC, Schedule 40, extruded from 100 percent virgin polyvinyl Chloride (PVC) compound, meeting requirements of class 1254-13 of ASTM D1784. Manufacturer: Spears, Charlotte.
Fittings shall be Schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466.

Manufacturer: Spears, Charlotte, Harvel Plastics Inc..

I. Piping and fittings:

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 0553: Plumbing Identification.

J. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I
PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Condensate Drain	All sizes	P-3	PF-3
Domestic Hot and Cold water,	All Sizes	P-3	PF-3
Storm and Overflow Drain	All sizes	P-1	PF-1
Natural Gas, Exterior	Underground, site only	P-5	PF-5a, and PF-5b
Natural Gas, Interior, aboveground	All sizes	P-4	PF-4a and PF-4b
Waste and Vent - Indirect	All sizes	P-2	PF-2
Waste and Vent – Sanitary/ Grease	All sizes	P-1	PF-1

1.

P-1: Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO IS 6.

Manufacturer: American Foundry, Tyler, AB & I.

PF-1: Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.

P-2: Copper drainage tube, inside structure and above grade. Type DWV hard temper, ASTM B 306.

Manufacturer: Mueller, Anaconda, Cerro Brass, Cambridge-Lee, Halstead.

PF-2: Cast brass drainage fittings ASA B 16.23, ASTM B 42.

Manufacturer: Mueller Brass, Nibco, Stanley Flagg, Lee Brass..

P-3: Copper water tube, Type L hard, ASTM B88. (For above ground use only.)

Manufacturer: Mueller, Cambridge-Lee, Halstead.

PF-3 Copper Press-Connect pressure fittings, comply with ASME B16.51 “Copper Alloy Press-Connect Pressure Fittings”, with Ethylene Propylene Diene Monomer, EPDM O-Ring Seal in each end. Fittings with the sizes of 2-1/2” and larger shall have cross-section Grab Rings and separation rings.

Manufacturer: Viega, Mueller Industries, Apollo.

P-4: Black steel pipe, Schedule 40, ASTM A53, Type E, ERW.

Manufacturer: US Steel.

PF-7a: Malleable iron, Class 125, ANSI B 16.3, threaded or welded Schedule 40 black steel for 2-inches and below and welded for 2 ½-inch and above.

Manufacturer: Stockham.

PF-4b: Press fittings, ASME B31, Carbon Steel, – For aboveground piping 2-inches and below. Provide fittings with Hydrogenated Nitrile Butadiene Rubber, HNBR Sealing Element.

Manufacturer: Apollo Valves: Power Press, Viega: MegaPressG.

P-5: Polyethylene plastic pipe, ASTM D 2513, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi and 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, orange or yellow color. Installer shall be certified by the manufacturer for this kind of joint installation.

Manufacturer: CPCHEM (Chevron Phillips Chemical Company LP) PE 2406.

PF-5a: Polyethylene plastic fittings, ASTM D 3261 and D 2683, Standard Dimension Ratio 11 rated at 80 psi working pressure and 73° Fahrenheit for 3 inches and smaller, SDR 11.5 rated at 76 psi at 73° Fahrenheit for 4 inches and above, butt or socket type fittings, joined by heat fusion, Installer shall be certified by manufacturer for joint installation. Color orange or yellow.

Manufacturer: CPCHEM, (Chevron Phillips Chemical Company LP).

PF-5b: Polyethylene transition risers, for PF-13a above, Transition fitting must have a minimum vertical height of 36 inches from the horizontal connection which will allow for a 6-inch steel riser above ground. Polyethylene transition risers shall be anodeless.

Manufacturer: GF Piping Systems.

K. Pipe Isolators:

PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe. ForCopper piping

Manufacturer: Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator.

L. Pressure Gage: Aluminum or steel case, minimum 4 ¼-inch dial; pressure type or combination vacuum-pressure type, with provisions for field calibration. Dial indicator to indicate pressure in psi with accuracy to within plus or minus 0.5 percent of maximum dial reading. Furnish gages with restriction screw, size 60, to eliminate vibration impulses. Black case and ring, bourdon tube of seamless copper alloy with brass tip and socket. Three way gage cock, constructed of brass with stuffing box, 1/2 inch couplings, with fixed or movable cap nut to shut off pressure gage.

PG-1 Pressure type, black drawn steel case, 4-1/2-inch glass dial, range approximately twice line pressure.

Manufacturer: Marsh Keckley, Trerice, Weksler, Weiss.

M. Plug Valves:

PV-1 2 inches and smaller: Rockwell No.114, lubricated plug type, 200-pound., water operating gauge pressure iron body and plug, regular pattern, threaded, with indicating arc.

Manufacturer: Walworth, Homestead, WKM.

PV-2. 2 ½-inch and larger: Rockwell No.115 and No.165 lubricated plug type, 200 pound water operating gauge. Iron body and plug, regular pattern, flanged, with indicating arc.

Manufacturer: Walworth, Homestead, WKM.

N. Safety Relief Valves:

SRV-1: Combination temperature and pressure relief type. CSA approved. Set to open at 125 psi pressure.

Manufacturer: Apollo Valves: 18C, Watts: 40L, Cash-Acme: NCLX-1.

SRV-2: Same as SRV-1, except provide on storage type water heater with anode in dip tube.

Manufacturer: Apollo Valves: 18C, Watts: 100XL, Cash-Acme: NCLX-1.

SRV-3 Spring type, ASME and NB stamped and certified with manual lifting device for air or gas.

Manufacturer: Apollo Valves, Bailey, Cash-Acme, Watts, Keckley.

O. Strainers:

STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blowout piping, same size as blowout plug.

1. 2-inch and smaller:
   C.M. Bailey No.100-A, 250 lb., cast iron body, threaded, Keckley: Style B, Spirax Sarco Y-type.

2. 2 ½-inch and larger:
   C.M. Bailey No.100-A, 125 lb., cast iron body, flanged, or Victaulic style 732, 300 psi, ductile iron body, grooved, fusion bonded epoxy coated.

   Manufacturer: C.M.Bailey, Armstrong, Muessco, Keckley 'A'.

STR-2 Y pattern cast iron bodies, 125 psi, monel screen. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2 inches, flanged ends fusion bonded epoxy coated for 2 ½-inch and larger perforations, in accordance with the following:

1. Steam service - 40 square mesh.

2. Other services - 16 square mesh.

Bailey No.100, Armstrong, RP&C, Keckley.

STR-3 Flanged, bucket type, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations, all sizes.

Manufacturer: Bailey No.1, Zurn 150 Series, RP&C, Keckley GF.

STR-4 Grooved, T-pattern, ductile iron body, 300 psi, stainless steel frame and mesh basket, grooved ends.

P. Vent Caps:

VC-1 Vandal-proof hood type, for plumbing vent lines.

Manufacturer: Stoneman Engineering and Mfg., Semco 1550.

Q. Flanges: Flanges shall be furnished and installed at each flanged connection of each type of equipment, tanks, and valves. Faces of flanges being connected shall be furnished alike. Connection of a raised face flange to a flat-faced flange is not permitted. Flanges shall conform to following schedules:

TYPE OF PIPE	FLANGE
Screwed black or galvanized grooved steel pipelines.	125-pound black cast iron screwed flange, flat faced or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401.
Welded or grooved steel pipe, except high pressure steam lines.	150-pound black forged steel welding flanges, 1/16 inch raised face ASTM A 105, Grade II or grooved flange adapters, Apollo Shurjoint 7041, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401.
Copper and brass pipe or tubing.	150 pound cast bronze, flat-faced flange with solder end or grooved flange adapters, Apollo Shurjoint C341, Victaulic Style 641, Tyco-Grinnell Fig. 61, Gruvlok Fig. 6084.

1. Gasket material for flanged connections shall be full faced or ring type to suit facing on flanges and shall be furnished in accordance with following schedule:

SERVICE	TYPE
Cold water	1/16-inch-thick neoprene

Grooved end flange adapters supplied with pressure responsive elastomeric Gaskets supplied with grooved flange adapters shall be pre-lubricated by the manufacturer. Grade of gasket to suit intended service.

R. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):

   a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.

   b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.

   c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.

   d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the ARCHITECT.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the ARCHITECT, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the ARCHITECT.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and

walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between two or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the ARCHITECT.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Provide polished, chrome-plated flanges when plumbing pipes pass through walls at plumbing fixtures, etcetera as specified in Section 22 10 00 Plumbing. Provide polished steel, chromium-plated split floor and ceiling plates at locations where pipes pass through walls, floors, ceilings, and partitions in finished portion that neatly conceals pipe insert.

8. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an OWNER-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the INSPECTOR with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

REFERENCE: ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-29 TESTS OF WELDERS AND WELDING OPERATORS.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an OWNER recognized, DSA approved testing laboratory.

ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-51 RADIOGRAPHIC EXAMINATION OF WELDED JOINTS.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

   a. Cracks of any type.

   b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

   c. Elongated slab inclusions longer than 1/4 inch.

   d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

   e. Undercuts greater than 1/32 inch.

   f. Overlaps, abrupt ridges or valleys.

3. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

4. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

5. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

REFERENCE, ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-52.

6. OWNER shall cause to be performed additional random UT and radiographic examinations of welds. OWNER shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

7. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of 2 pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the OWNER in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM A53, Type B, steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

2. Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Hot tapping of gas lines is strictly prohibited.

3. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

   a. Soap Piping: Litharge and glycerine, or Expando, Gasoila.

   b. Plastic Piping: Teflon pipe joint compound tape.

   c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.

   d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.

   e. Other services furnish sealant, suitable and as reviewed by the ARCHITECT.

4. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.

5. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

6. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3. Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool.

7. Pressed fittings for copper or copper alloy pipe or tubing shall have an elastomeric O-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, mechanically cleaned and reamed prior to joining to remove all burrs (interior and exterior) and restore full inside diameter and a smooth, chamfered exterior surface. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

   a. Press Installation Training Requirement: Installation training shall be provided on site by manufacturer personnel and documented with Engineer. Installation procedures, depth guides, and tool inspection shall be provided by manufacturer for all product types (steel or copper) for reference and safety assurance.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool.

O. Stainless steel press joints: Joints shall be Vic-Press 304TM, made with Victaulic Series ‘PFT’ tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Polyethylene (Plastic) Pipe:

1. Joints shall be installed by the heat fusion method, in accordance with manufacturer's recommendations and IAPMO installation standard IS 12, for natural gas.

2. Pipe Riser at Meter, Regulator and Building Wall: Prefabricated, anodeless type, utilizing a grade level transition between underground polyethylene pipe and gas

supply steel pipe of riser outlet, GF Piping Systems. Below grade to above grade transition shall be installed in a welded, epoxy coated, steel casing.

3. Connections to Existing Pipe Line or Branch:

   a. Steel-to-plastic (PE): Provide manufacturer's prefabricated standard transition fitting, transition from epoxy-coated steel pipe to plastic, R. W. Lyall Co..

   b. Plastic-to-plastic, PVC to PE: Provide manufacturer's prefabricated standard transition fitting, transition from PVC to epoxy-coated steel pipe to PE; R.W. Lyall Co..

   c. Plastic-to-plastic, PE to PE: Provide manufacturer's standard fused tapping tee assembly with shut-off feature.

4. Provide PE reinforcing sleeves where PE pipe is fused to multi-saddles, service punch tee, reducing tees, transition fittings and anodeless risers.

Q. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

4. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

5. Valves for similar service shall be of one manufacturer.

6. Except where otherwise specified, valves shall be Apollo, Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman.

7. Ball valves below grade in yard boxes shall have stainless steel handles.

8. Hose bibs in dense garden areas shall be ¾ inch in size with one hose bib in the lunch pavilion 1 inch in size. Other hose bibs shall be ¾ inch lock shield type. Bibs shall be furnished with vacuum breaker protection.

9. Safety valves and pressure relief valves shall have stamp of approval as required by ASME and shall be provided with annual test lever. Where a hot water storage tank is heated by means of a coil, pressure relief valve shall have a steam BTU discharge rating of the coil. Discharge pipe from safety or pressure relief valves shall be not less than one pipe size larger than inlet pipe size of valve. Discharge pipe shall terminate as indicated and shall be free of traps. In addition to locations specified, pressure relief valves shall be installed in the following locations:

   a. On discharge side of each pressure-reducing valve.

b. On each water heater connected to a hot water storage tank and other pressure vessels.

c. On cold water line to each water heater or hot water storage tank when there is a check valve, backflow prevention valve or similar device between water heater or hot water storage tank and meter or relief valve at the pressure reducing valve assembly.

d. On discharge side of each air compressor.

e. On each air receiver connected to an air compressor.

10. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

11. A combination temperature and pressure relief valve or combination of valves on each heating hot water storage tank. Temperature sending element shall extend into water inside tank.

12. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

R. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc..

S. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer’s Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Hose faucets, compressed air outlets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.

3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.

5. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by ARCHITECT and DSA.

6. Burning holes in beam flanges or other structural members is not permitted without review by the ARCHITECT and DSA.

7. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

8. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, as follows:

   a. Tolco I beam, Fig.62 for maximum 1000 pounds.

   b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.

9. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, as follows:

   a. Tolco Fig.310 for maximum of 600 pounds.

   b. Tolco Fig. 309 for maximum of 1140 pounds.

10. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.

11. Pipe hanger rod sizes: 3/8-inch for pipe sizes ½-inch through 4-inch, ½-inch for pipe sizes 5-inch through 8-inch, and 5/8-inch for pipe size 10-inch through 12-inch.

12. Where rod hangers are used with a diameter greater than 3/8-inch, they shall be equipped with swivels or eye nuts to prevent bending in the rod.

13. Turnbuckles, if furnished, shall provide a load carrying capacity to that of the pipe hanger with which they are being installed.

14. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

15. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

16. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

17. Vertical Piping:

    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

    b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

    c. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

    d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

18. Horizontal Piping:

    a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block,. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

    b. Insulated steam and space heating hot water insulated condensate lines, insulated domestic hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Grinnell Figure 212, steel hangers with welded eye rods to permit hinge movement at point of attachment of hangers. Hinge movement at point of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Grinnell Figure 278.

    c. Domestic cold water piping, water supply and return piping, condenser water piping, insulated refrigerant piping gas piping, compressed air piping, cast iron soil piping, galvanized steel vents, waste and downspout piping and glass to be supported with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, hangers with rods, turnbuckles and inserts suitable for above hangers.

    d. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

19. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

20. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

21. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

T. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Install caps on top of heater pipes. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct by welding. No soldered joints on roof flashings will be allowed. No Stoneman lead roof flashings will be allowed.

3. Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 8 inches.

4. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

5. Cast iron, steel, brass, and copper pipe, which terminates less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

6. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of ¾ inch.

7. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

8. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

U. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 0548 even if not indicated on Drawings.

END OF SECTION

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:

1. Division 01: General Requirements
2. Section 21 13 13: Fire Suppression Sprinkler Systems.
3. Section 22 05 13: Plumbing Materials and Methods.
4. Section 22 10 00: Plumbing.

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 05 00: Plumbing Common Work.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 22 05 00: Plumbing Common Work.
2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.
3. APWA: Uniform Color Code.
4. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	Length of Color Field (in inches)	Size of Letter (in inches)
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
over 10	32	3 ½

D. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot-water 140ºF	Domestic H.W. 140ºF	Blue	Black
Sanitary waste	San waste	Green	White
Sanitary vent	San vent	Green	White
Storm drain or downspout	Storm drain	Green	White
Indirect drain	Ind drain	Green	White
Sump pump discharge	Pump discharge	Green	White
Fire sprinkler supply	Fire Sprinkler supply	Red	White
Fire sprinkler drain	Sprinkler drain	Red	White
Fuel oil	Diesel oil	Yellow	Black
Gas	Gas	Yellow	White
Reclaimed Water	Caution: Reclaimed Water Do Not Drink (1)(3)	Purple	Black

H. Notes on Schedule:

1. Note (1) indicates 2 ¼ inch by 1 inch yellow label with ½ inch letters reading UNSAFE WATER at one end of primary label.

Note (2) words should read “CAUTION: NONPOTABLE WATER DO NOT DRINK.” with international *do not drink* symbol.

Note (3) words should read “CAUTION: RECLAIMED WATER DO NOT DRINK.” with international *do not drink* symbol.

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

a. Yellow: Oil and gas.

b. Blue: Water, irrigation and slurry lines.

c. Green: Sewer and drain lines.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistant insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulation for plumbing piping.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 22 05 00: Plumbing Common Work
3. Section 22 05 13: Plumbing Materials and Methods.
4. Section 22 05 53: Plumbing Identification.
5. Section 22 10 00: Plumbing.

1.02 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM C302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation.
2. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
3. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
5. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
6. ASTM C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
8. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. Underwriters Laboratories, Inc.

1. UL 723 - Test for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. California Code of Regulation Title 24.

1. California Green Building Standards Code.

1.03 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 05 00: Plumbing Common Work.

1. Complete material list of items to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements.

3. Shop Drawings, catalog cuts and manufacturer's data indicating insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California quality standards for insulating materials.

4. Display sample cutaway sections.

5. Manufacturer's recommended method of installation procedures, which will become part of this Section.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer and Installer, Materials, Fabrication, Execution, and Standard of Quality: Comply with provisions stated under Section 22 0500: Common Work Results for Plumbing and Section 22 0513: Basic Plumbing Materials and Methods.

B. Insulation Work shall be in accordance with the California Building Energy Efficiency Standards, CBC, and Uniform Mechanical Code and the California Green Building Standards Code.

C. Test Ratings:

1. Comply with provisions stated under Section 22 0500 and 22 0513 with emphasis on ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, UL label or listing of satisfactory test results from the National Institute of Standards and Technology, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.

2. Furnish labels, legibly printed with the name of the manufacturer or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for installation. Flame spread index of not more than 25 and smoke developed rating not exceeding 50.

3. Tests shall be performed on each item individually when insulation, vapor barrier covering, wrapping materials, or adhesives are installed separately at the Project site.

4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

D. Regulatory Requirements: Insulation furnished and installed under this Section shall meet minimum legal requirements of the Building Energy Efficiency Standards adopted and incorporated in the California Energy Commission, Title 24, Part 2, Chapters 2 through 53 and the California Green Building Standards Code unless otherwise noted, for the piping,

E. Chemically based products such as sealers, primers, fillers, adhesives, etcetera must meet the California air quality regulations.

1.05 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 22 0500: Common Work Results for Plumbing and 22 0513: Basic Plumbing Materials and Methods.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. Insulating material shall be fire resistant, non-corrosive, shall not break, settle, sag, pack or disintegrate under vibration, nor absorb more than 1 percent moisture by weight.

2. Insulating material shall be furnished with thickness indicated in Table 1, and shall furnish thermal resistance in the range of R-4.0 to 4.6 in accordance with inch at 75 degrees F. For any other value of R, insulation thickness shall be calculated accordingly and submitted for review.

3. Asbestos in any quantity in insulating material is not permitted.

4. Provide insulation materials, adhesives, coatings, sealants, fitting covers, and other accessories with a fire hazard rating not to exceed 25 for flame spread, 25 for fuel contributed and 50 for smoke developed, except for materials listed as follows:

   a. Nylon anchors for installing insulation to equipment.

   b. Treated wood blocks.

5. Flame-proofing treatments subject to moisture damage are not permitted.

TABLE 1 - MINIMUM PIPING INSULATION THICKNESS (1)

Insulation Thickness Required (in inches)

Piping System Type	Temp. Range (degrees F)	Runouts up to 2 (2)	1 and less	1.25 to 2	2.5 to 4	5 to 6	8 and larger
Service Water Heating Systems (recirculating, piping supply and return)							
Hot Water	Up to 180	0.5	1.0	1.0	1.5	1.5	1.5
Condensate Drain	½ inch minimum insulation thickness.	0.5	0.5	0.5	0.5	0.5	0.5
From A/C Equipment:	Insulate condensate drain lines within building, in room, inside walls and above ceilings.	0.5	0.5	0.5	0.5	0.5	0.5

NOTES: (1) For piping exposed to ambient temperatures, increase thickness by 0.5 inch.

(2) Runouts to individual terminal units, not exceeding 12 feet in length.

B. Lagging Adhesives: Shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Insulation finished with canvas shall be provided with laps adhered in accordance to manufacturer's recommendation. A finish coat of same material shall be applied to entire outer surface of lagging cloth at coverage specified by manufacturer.

C. Canvas Jackets: Provide 6 ounce, in accordance with square foot minimum, 48 by 48 thread count canvas jacketing.

D. Insulation Jackets:

1. Exterior insulation exposed to weather shall be weatherproofed with Childers aluminum jacketing as basis of design, or Pabco, RPR, or equal. Jacketing shall be manufactured from 1100, 3105 or 5010 aluminum alloy with 3/16 inch corrugations. Smooth or embossed jackets may be permitted in special situations to match an existing installation. Jacketing shall be furnished with an integrally bonded moisture barrier over entire surface in contact with insulation. A minimum thickness of 0.016 aluminum jacketing is to be provided on ducts and piping. A minimum thickness of 0.020 shall be provided on tanks, equipment, and heat exchangers.

2. Insulated elbows, of 90 degrees and 45 degrees, with a nominal iron pipe size of ½ inch to 8-inch shall be provided with Childers aluminum Ell-Jacs insulation covers as basis of design, or Pabco, RPR, or equal, manufactured from 1100 aluminum alloy of 0.024 inch thickness. Insulated elbows with a nominal pipe size of 10-inch to 18-inch shall be provided with Childers 4-piece aluminum Ell-Jacs as basis of design, or Pabco, RPR, or equal.

3. Tees, Flanges, and Valve Insulation in Conjunction with Aluminum Jacketing: Furnish Childers Aluminum Special Fabrications Insulation Covers as manufactured by Childers Products Company, Pabco, RPR, or equal.

E. Adhesives: Adhesives shall be water based, UL Classified, meet the requirements of NFPA 90A and NFPA 90B, have been tested according to relevant ASTM requirements, and be acceptable to the State Fire Marshal. Name, type and method of installation shall be submitted for review.

F. Valve and Fitting Cover: When installed in conjunction with PVC jacketing, furnish Zeston 25/50 rated polyvinyl chloride fitting covers as manufactured by Johns Manville, Knauf Insulation, Speedline, or equal.

2.02 DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Insulate domestic hot water supply and return piping, including valves, strainers and fittings with insulation thickness as indicated on Table 1.

B. Materials:

1. Classes of Insulation:

a. Class A: Glass fiber molded pipe insulation suitable for service temperatures up to 850 degrees F. Pipe insulation shall be one piece, preformed, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire retardant vapor barrier jacket. Pipe insulation shall be Johns Manville Micro-Lok, Knauf Redi-Klad 1000, Owens Corning FIBERGLAS Pipe Insulation SSL II-ASJ, or equal.

b. Class B: Flexible open-cell melamine (foam insulation) suitable for service temperature -150 degrees F to 400 degrees F. Thermal conductivity at 75 degrees F, K= 0.26. Pipe insulation, one-piece pre-formed, laminated to heavy non-reinforced PVC jacket, with locking track, factory installed to jacket, to snap insulation and jacket onto pipe. Similar to TechLite 079 Series as manufactured by Accessible Products Co., or equal. Installation shall comply with manufacturers recommendations.

c. Class C: Mineral fiber pipe insulation suitable for service temperatures up to 1200 degrees F. Pipe insulation shall be one-piece, preformed up to 3 inches thick, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be 8 pounds in accordance with cubic foot density by Roxul Techton 1200, Fibrex COREPLUS 1200, Industrial Insulation Group, LLC (IIG) MinWool-1200, or equal.

2. Locations and Class of Insulation Required:

TABLE 2 – LOCATIONS AND CLASS OF INSULATION REQUIRED

LOCATION	CLASS OF INSULATION
Equipment Room	A, B or C
Other Locations	A, B or C

3. Fittings on indoor piping shall be covered with flush, hand-wrapped Class A, B, or C insulation, to match the adjoining pipe insulation and covered with polyvinyl chloride fitting covers: Zeston 2000 25/50 by Johns Manville, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal.

4. Adhesive: Fibrous Adhesive to bond calcium silicate to itself and non-porous surfaces.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Except as specified herein, install material in accordance with recommendations of manufacturer. Do not install insulation materials until tests specified in other sections are completed. Remove foreign material such as rust, scale, or dirt. Surfaces shall be clean and dry. Maintain insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be provided and maintained, insulation shall be installed with a continuous, unbroken moisture and vapor seal. Hangers, supports, anchors, or other projections that are fastened to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Surface finishes shall be extended in such a manner as to protect raw edges, ends, and surfaces of insulation.

D. Pipe insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in the following locations unless otherwise noted:

1. On unions, flanged connections or valve handles.

2 Over edges of any manhole, clean-out hole, clean-out plug, and to restrict opening or identification of access.

3. Over any label or stamp indicating make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.02 INSTALLATION OF DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Domestic hot water, tempered water supply and return piping and condensate return piping, after having been tested, shall be cleaned and insulated.

B. Application: Insulate condensate return piping, domestic hot water supply and return, including tempered supply and return piping in accordance with manufacturer's instructions and as specified herein.

1. Install insulation on valve bodies up to valve bonnet. Fill void in saddles, in accordance with Section 22 0513: Basic Plumbing Materials and Methods, with insulation and seal joints.

2. Install insulating material to fittings, valves, and strainers and smooth to thickness of adjacent covering. Leave strainer clean-out plugs accessible. Covers fabricated from polyvinyl chloride shall be furnished.

C. Insulation Jackets in Exposed Indoor Locations:

1. Cover completed insulation with canvas jacket tightly pasted to covering with lagging adhesive. Lap jacket seams 1 1/2-inch minimum. Finish entire jacket with coating of undiluted adhesive.

2. Equivalent factory applied pre-sized, glass fiber reinforced, or glass fiber jackets may be furnished. Seal jacket seams with adhesive in accordance with manufacturer's instructions.

3. Johns Manville Zeston 2000, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal, fitting covers may be furnished, with molded or segmented insulation equal to specified insulation applied to fittings. Secure covers in accordance with manufacturer's instructions.

4. In addition to above requirements, cover exposed insulated piping within a distance of 8 feet above floors with 26 gage galvanized steel jacket. Omit jacket in areas accessible only to maintenance personnel, such as mechanical equipment rooms, utility corridors, accessible pipe tunnels and manholes.

D. Concealed Indoor Locations: Cover insulation over fittings, valves, and strainers with canvas. Provide pipe insulation with factory or field applied standard jacket of 4 ounce minimum canvas, fiberglass cloth, or glass fiber reinforced jacket. Seal jacket laps with adhesive in accordance with manufacturer's instructions.

E. Exposed Outdoors: In addition to canvas or fiberglass cloth cover, pipe insulation exposed to weather shall be provided with an additional 0.016 inches thick aluminum jacket with 2-inch lap connected with one inch hem overlap joint located on side of pipe and turned down to shed water. Jacket shall be strapped 12 inches on center with ½-inch wide stainless steel strapping and wing seals. Aluminum jacket shall be mitered to fit fittings.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

END OF SECTION

SECTION 22 10 00 - PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:

1. Division 01 - GSSSeneral Requirements.
2. Section 22 05 00: Plumbing Common Work.
3. Section 22 05 13: Plumbing Materials and Methods.
4. Section 22 05 53: Plumbing Identification.
5. Section 22 07 00: Plumbing Insulation.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 05 00: Plumbing Common Work.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.03 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 05 00: Plumbing Common Work.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.04 PRODUCT HANDLING

A. Conform to provisions of Section 22 05 13: Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.01 PIPING SYSTEMS

A. Materials: Refer to Section 22 05 13: Plumbing Materials and Methods.

B. Insulation for Piping: Refer to Section 23 07 00: Plumbing Insulation.

2.02 FIXTURES AND DRAINS

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel, and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:

1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.

2. Finished and exposed brass plumbing, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:

1. Fixture Traps shall be all L.A. Code Cast Brass Chromium-plated and polished. Exceptions as follows:

a. Traps that are an integral part of a fixture.

b. Traps concealed in floors, walls and furring.

c. Traps standard for service sinks and Industrial Shop equipment.

d. Laboratory traps and tailpieces shall be as specified in section 22 05 13 “Plumbing Materials and Methods”.

2. Trap Arms shall be all IPS Threaded Brass Nipples into Female IPS Threaded Drainage Tee.

3. Tailpieces, Extension Tailpieces, 2-part wastes and any other tubular products shall be minimum 17 gage polished chromium-plated brass, except as otherwise specified.

4. Furnish polished chromium-plated brass wall flanges with setscrews and polished

chromium-plated brass cover casing on discharge side of each trap.

D. Faucet and Shower Valve Handles: Faucet and shower valve handles shall be solid brass, chromium-plated and polished, and fastened to their stems by Allen type hollow head stainless steel set screws through the side of the handle extending into the stem. Handles with sharp edges or projections shall not be furnished. At accessible fixtures: handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate handles shall be 5 pounds maximum.

E. Fixture Supplies:

1. Supplies for water heaters shall be unplated rigid copper water tube with threaded adaptors for connections to valves and other threaded connections. All other supplies shall be chromium-plated brass with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

2. Exposed supplies for showers shall be chromium-plated brass pipe up to header with hospital threads or shall be furnished with fittings and valves, which completely cover threads.

3. Supplies to water closet tanks, lavatories, and drinking fountains shall be furnished with a NSF 372/61 threaded brass nipple. Exposed unfinished piping shall be sleeved with chrome plated brass or copper cover casing and have an appropriate escutcheon for a clean finished appearance. Angle/straight valve stops shall be female 1/2 IPS (inlet) by 3/8 compression (outlet). Fixture supplies shall be polished chrome-plated, solid supply bulbed end risers with size compatible supply nut connection to fixture and 3/8 O.D. compression nut and ferrule connection to angle stop outlet. Stainless steel flexible braided connectors with re-enforced PVC inner hose are not allowed.

4. Hot and cold water fitting supply outlet piping serving water closets, urinals, lavatories, drinking fountains, sinks, faucets, hose bibs, and sillcocks shall be iron pipe size (IPS) brass nipple, and piped in such a manner that through wall water supply outlet piping be removable, size appropriate, and lead free. The use of copper, copper MIP sweat adapters or similar fittings, in lieu of brass nipples is not allowed. The IPS brass nipple shall be directly connected to the fixture as follows:

   a. Control stops for water closet and urinal flush valves.

   b. Angle stop for lavatories, sinks and drinking fountains.

   c. Shank/arm adapters for wall mounted sink faucets.

   d. Iron pipe size (IPS) brass nipple connection for hose bibs, sillcocks, and other plumbing related fixture and/or plumbing fitting water supply outlets.

5. Water supply pipe that penetrates a finished surface, wall, countertop or part of a cabinet shall be appropriately sized polished chromium-plated cover casing and

wall flange/escutcheon fitting tight to the brass through wall nipple and securely affixed to the finished wall surface.

6. Water supplies of plumbing fixtures shall be protected against back-siphonage in event of a vacuum in piping system. Toilet and urinal flush valves shall be furnished with recognized atmospheric vacuum breakers, installed a minimum of 6 inches above fixture.

7. Discharge outlets of supply faucets for lavatories and sinks shall clear top of overflow rim by at least one inch.

2.03 ACCESS PLATES (To cleanouts, valves, water hammer arrestors and hose faucets)

A. Schedule Numbers:

AP-1: Square, unless otherwise noted, steel, prime coated; frame, 18 gage minimum. Door shall be 16 gage minimum with concealed hinge or be removable, with vandal-proof lock operated by Allen wrench. (Specify for painted and stucco walls.)

SMITH	ZURN	ELMDOR	MILKOR	WATTS	MIFAB	JOSAM
Fig 4760 AK	Z-1462-VP	DW-AKL	MOR DW AK1	CO-300-S-6	UA-A	58650-VP

AP-2: Round type, stainless steel, vandal-proof, 5/16 inch No. 18 or 1/4 inch No. 20 flat-head machine screw into cleanout plug. Plate shall be prime coated minimum 18 gage steel or polished chrome-plated brass, 18-8 No. 302 stainless steel, or polished nickel bronze. (To be specified for painted walls, screwed into cleanout plug.)

SMITH	ZURN	JOSAM	WADE	WATTS	MIFAB
4710U	Z-1469-VP	58600	8480R	CO-480-RD-6	C1400-RD-6

AP-3: Square, polished face chrome-plated bronze, aluminum alloy or brass chrome-plated brass frame with 14 gage polished 18-8 No. 302 stainless steel or brass chrome-plated secured cover with vandal-proof screws. (To be specified for tile walls.)

SMITH	ZURN	WADE	WATTS	MIFAB	JOSAM
4735U	Z-1460-VP	58630	CO-300-S-6	C1400-S-3-6	58640-VP

2.04 BACKFLOW PREVENTION ASSEMBLIES

A. Schedule Numbers:

BPV-1: Reduced pressure or pressure differential type, City of Compton approved. Sizes ½ inch to 6-inch.

WILKINS	WATTS	FEBCO	AMES
375 and 975 XL (for uninterrupted service)	LF009-QT; LF909-NRS	LF860	4000SS

BPV-2: Pressure vacuum breakers with 3/4 inch hose bib. Install 6 feet above finished floor.

WILKINS	WATTS	FEBCO
420XL	LF008PCQT	LF765

2.05 CLEANOUT ASSEMBLIES

A. Cleanout plug shall be line size.

B. Schedule Numbers:

CO-1: Iron body cleanout tee full line size up to 4 inches and round access plate, plugs shall be brass, countersunk with tapped boss for 5/16 inch No. 18 or ¼ inch No. 20 screws. (Specify for finished walls at base of waste stack, above urinal and service sink.) AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn.

SMITH	ZURN	WATTS	MIFAB	JOSAM
4532-U	Z-1446-BP	CO-460-RD-34B	C1460-RD-6	58600-CO

CO-2: Iron body with approved UPC plug, top and adjustable sleeve, cut-off ferrule, polished scoriated brass nickel bronze secured cover. AB&I and TYLER may be used as iron body cleanouts. Trim and accessories shall be Smith or Zurn(To be specified for finished floors inside buildings, in covered areas, and in concrete paving.)

Square:

SMITH	ZURN	WATTS	MIFAB	JOSAM
4053L-U-NB	ZN-1400-T	CO-200-S	C1220-S-1-6	55000-1-SQ

Round:

SMITH	ZURN	WATTS	MIFAB	JOSAM
4033-L-U-NB	ZN-1400	CO-200-R	C1220-1-6	55000-1

CO-3: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferule, UPC. Brass approved type plug, scoriated tractor type cover.

(To be specified for areas outside building on concrete paving.)

SMITH	ZURN	WATTS	MIFAB	JOSAM

4233-U	ZN-1400-HD	CO-200-RX-4	C1220-4-6	55000-22

CO-4: Tapped soil tee with brass plug, full line size.

(Specify for above grade, outside building at base of exposed downspout.)

SMITH	ZURN	WATTS	MIFAB	JOSAM
4512	Z-1445-BP	CO-460-34A	C1460	58910

CO-5: Raised threaded head brass plug.

(To be specified for yard box YB-3.)

ZURN	WATTS	SMITH	JOSAM
Z-1470-A	CO-590	4285	58540-20

2.06 CIRCULATING PUMPS, HOT WATER HEATING SYSTEM

A. Schedule Numbers:

CPH-1: Centrifugal, single stage, close coupled with adjustable cast iron base, bronze enclosed impeller, lead-free mechanical shaft seal suitable for water temperature range from 20 degrees to 300 degrees F. Screwed or flanged connections. GPM and TDH capacities as indicated.

BELL & GOSSETT	WEIMAN	PACIFIC	TACO

CPH-2: In-line mounted. Close coupled, centrifugal type with an all bronze water chamber, bronze sleeve bearings, bronze impellers, water tight shaft seal suitable for water temperature range from 20-300 degrees F. Forged steel shaft. It must be provided with bracket support to damper vibrations. GPM and TDH capacities as indicated.

BELL & GOSSETT All Bronze	GRUNDFOS	TACO

2.07 DIELECTRIC UNIONS

A. Schedule Numbers:

1. Dielectric style Unions using ferrous and no-ferrous metals are prohibited. Dielectric flanges are admitted for use – see DU-2.

DU-1: Lead Free Brass union with 6-inch Lead Free Brass nipple.

DU-2: Lead Free Brass union or Lead Free Brass flanged fittings are to be used in between pipes made of dissimilar metals to prevent accelerated corrosion and deterioration in the piping systems due to galvanic and stray current.

WATTS	NIBCO
LF3100M3	733-LF

2.08 EMERGENCY EYE WASH / EMERGENCY SHOWER

A. Schedule Numbers:

EEW-1: Access compliant combination emergency shower and fold-away eyewash mounted in a flush mounted recessed stainless steel cabinet with concealed piping: Eyewash: eye/face wash in a stainless steel door/water tray assembly folds up flush into stainless cabinet. Shower: access compliant shower activation by pull lever handle mounted 42 to 45 inches above the finished floor, located inside of stainless steel cabinet, supplying an exposed 20 gpm flow regulated stainless steel shower head, mounted between 82 and 96 inches above finished floor. Unit is access compliant when eye/face wash spray outlet is mounted at a height of 36 inches above finished floor. Provide 30 inches wide by 48 inches deep clear floor space for access compliance.

HAWS	GUARDIAN	ACORN SAFETY	BRADLEY
8356WCC	GBF2150-FC20	S2260-BF-PAN-RA	S19345JXB

2.09 ELECTRIC WATER COOLERS

A. Water Coolers shall be provided with brass free waterways and lead mitigating water filtering systems (DFWF).

B. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are Haws, Murdoc and Elkay

2.10 FAUCETS

A. Access compliant faucets: Force to activate controls shall be no greater than 5 pounds. Self-closing metering, where specified, to remain open 10 seconds minimum when activated. Handles shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

C. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design, Acceptable manufacturers are Chicago, T&S and American Standard.

2.11 FLOOR DRAINS

A. Schedule Numbers:

FD-1: Cast iron body, no hub with seepage pan and flat, round nickel bronze strainers not less than 5-inch diameter for 2-inch outlet bodies, 7-inch for 3-inch outlet bodies and 8-inch for 4-inch outlet bodies, with maximum of ½ inch square holes or slots not larger than ¼ inch by 1 ¼-inch.

(To be specified for use in locations other than tile floors.)

SMITH	ZURN	WATTS	MIFAB	JOSAM
2005Y-A	ZN-415-B	FD-100-A	F1100-C-1	30000-A

FD-2: Same as specified for FD-1, except with square tops.

(To be specified for use in tile floors.)

SMITH	ZURN	WATTS	MIFAB	JOSAM
2005Y-B	ZN-415-S	FD-100-M	F1100-C-S-1	30000-S

FD-3: Area type, with 8-inch diameter minimum cast iron top grates (no hub). Drain shall be vandal-proofed by securing grate to body with stainless steel Allen flat-head screws.

SMITH	ZURN	WATTS	MIFAB	JOSAM
2110-Y-U	Z-550-VP	FD-320-Y-6	F1320-4-6	32100-VP-Z

FD-4: Gang shower, cast iron body with 5-inch diameter nickel-bronze vandal-proof strainer. No hub.

SMITH	ZURN	WATTS	MIFAB	JOSAM
2005-Y-NB-U-(A)	ZN-415-B-VP	FD-100-A-6	F1100-C-1-6	30000-A-VP

FD-5: For indirect waste. Cast iron body, with vandal-proof nickel-bronze top and funnel. No hub.

SMITH	ZURN	WATTS	MIFAB	JOSAM
3510-F11-NB5	ZN-415-E	FD-100-EF-1	F1100-C-EF-1	30000-E2-VP

FD-6: Area drain, cast iron body, round pedestrian grate set in square frame.

SMITH	ZURN	WATTS	MIFAB	JOSAM
1470Y-U-NB	ZN-158-VP	RD-200-CP-L-1	F1100-C-S8-1-6	23730-VP

FD-7: Trash Drain Wash down Area Drain: Waste water diversion valve drain acts as an area drain for sanitary and rain drainage. When the hose Bibb is activated, the drain automatically diverts run offs to sanitary drain.

FOX Waste Water Diversion Valve System:

DD 600

2.12 FLEXIBLE HOSES

A. Schedule Numbers:

FLH-1: Braided stainless steel metal hose (for gas use). US Flex, Metraflex, Nelson Dunn.

FLH-2: Braided bronze metal hose (for non-pressure condensate connection use). US Flex, Metraflex, Nelson Dunn.

2.13 FLUSH VALVE ASSEMBLY

A. Valves shall be furnished so that flush remains constant and will not require any adjustment.

1. Each flush valve shall be provided with a loose key, square shank, lock shield angle service stop connected to flush valve with a union connection.

2. Provide l7 gage pressed brass escutcheons for wall and fixture. Escutcheons shall be fastened to not turn or rattle.

3. Each flush valve shall be furnished with a vacuum breaker providing one inch opening to atmosphere, which will not leak under any degree of back pressure and will not restrict rate of flow more than 10% at 10 PSI, and will operate noiselessly.

4. Tailpiece shall not be lighter than 17 gage and shall be part of flush valve assembly.

5. Exposed metal parts of flush valve assembly shall be nickel or chromium-plated on a brass or copper base.

6. Controls for water closet flush valves shall be mounted on the wide side of toilet areas.

B. Schedule Numbers:

FLV-1: Manual Flush Valve for Water Closet: Shall deliver 1.28 gallon of water at each operation.

SLOAN	ZURN
Royal 111-1.28	Z6000AV-HET

FLV-2: Manual Flush Valve for Urinals: shall deliver 1/8 gallon of water per flush.

SLOAN	ZURN
Royal 186-0.125-DBP	Z6003AV-ULF

2.14 FLOOR SINKS

A. Schedule Numbers:

FS-1: 6 inches to 8 inches deep, square cast iron acid-resistant enamel, bottom aluminum dome strainer with nickel bronze rim and grate top.

SMITH	ZURN	WATTS	MIFAB	JOSAM
3140Y 3150Y	Z-1901 ZN-1900	FS-740-1 or FS-730-1	FS1720-1, FS1730-1	49320A-NB, 49340A-NB

2.15 HOSE BIBBS

A. Schedule Numbers:

HB-1: For plaster or stucco wall, furnished with box and stop, exposed trim chrome-plated, with or without door and with vacuum breaker.

ACORN	WOODFORD	PRIER
8141, 8151	B75	C-633NFC

HB-2: For brick, CMU and poured in place concrete walls, furnished with box and stop, exposed trim chrome-plated, with or without door and with vacuum breaker.

ACORN	WOODFORD	PRIER
8141, 8104, 8151	B75	C-633NFC

HB-3: ASTM B 62 bronze body, rubber composition disc or renewable seat, bent nose with brass die cast or enamel iron hand wheel and with vacuum breaker. (To be specified for use at roof top AC Unit. Mechanical Equipment Room, Boiler Rooms, etc.)

ACORN	ZURN	CHAMPION	PRIER
8126-LK-RBVB	Z-1343-VB-LK	B-401 LK	C-255NP

HB-4: Recessed hose box furnished with wall flange and built-in drip lip. Box shall be one piece construction; door shall have a recessed cam lock. Door shall remain up and out of the way when in fully opened position. Valve shall be replaceable loose key wheel handle and screwdriver stop. Install within 2 feet above finished floor. Provide vacuum breaker.

(To be specified for use in Toilet Rooms.)

ACORN	WOODFORD	PRIER
Hose box 8104 or 8151	B75	C-634BX1

2.16 LAVATORIES

A. Access compliant faucets for Lavatories: Force to activate controls shall be no greater than 5 pounds. Self-closing metering, when specified, to remain open 10 seconds minimum when activated.

B. Cast Iron Lavatories shall be acid resistant enamel and shall conform to Commercial Standards CS 77.63. Unites furnished in conjunction with strainer installation or faucet installation shall be brass. Exposed brass nuts shall be chrome plated.

C. Exposed trim shall be free from sharp edges or points. Fixture shall be furnished with other listed manufacturer specified trim. Instead of solid supply pipe, polished chrome-plated risers, 3/8 inch outside diameter with ferrule stop end and metal nosepiece may be furnished.

D. Insulate cold water, hot water and drain lines under all access compliant lavatories with approved type insulation.

PLUMBEREX	LAV-GUARD

E. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are Kohler, Sloan and American Standard.

	BRASS CRAFT	CHICAGO	ZURN
Drain		327 XCP	Z8743
Supply	HSTR 1720 A-CB-C	1017	ZH-8822-CE-LK

Note: Provide cast iron hangers for sinks.

2.21 PIPE HANGERS

A. Refer to Section 22 0513: Basic Plumbing Materials and Methods.

B. Schedule Numbers:

1. PH-1: Complete with clamps, inserts, etc.

2.22 P-TRAPS

A. Schedule Numbers:

PT-1: Cast brass complete, chrome-plated.

AB&A
107

2.23 PRESSURE REGULATING VALVE ASSEMBLIES

A. Schedule Numbers:

PRV-1: Furnish for sizes ½-inch to 2-inch water service, all bronze body, stainless steel seat, bronze strainer, calibrated springs, and corrosion resistant, adjustable control.

WILKINS	WATTS
500XL- YSBR-HLR	LF223S-B-HP

PRV-2: Furnish for sizes 2 ½-inch and larger: Automatic (pressure) control valve-pilot controlled and diaphragm actuated pressure control valve, straight or angle pattern, flanged inlet and outlet connection, fusion bonded epoxy coated inside and out with stainless steel cover, stainless steel pilot, stainless steel bolts and nuts, and stainless steel flexible tubing in a compact configuration, vandal resistant bolt-on pilot controller, ¼ ball valve on all pilot control lines, and stainless steel internal parts.

WATTS	CLA-VAL
LFM115	90-01

PRV-3: Furnish for gas service, spring-loaded model, Buna N rubber composition or leather valve seat disc and diaphragm, inlet pressure 125 pound maximum.

REPLANCE	FISHER	SENSUS
1813C	S-100. 166-1, S-201, 166-2	121

PRV-4: Furnish for gas service for (unit heaters, boilers, and similar installations). Spring-loaded model, Buna N rubber composition, or leather valve seat and diaphragm suitable for temperatures to 150 degrees F.; maximum inlet pressure one pound. Outlet pressure 4 inches to 10 inches adjustable; orifice to suit. For pilot lines and main burners.

REPLIANCE	MAXITROL	HONEYWELL
A3000 Series	RV	V5172 Series

2.24 ROOF DRAINS

A. Schedule Numbers:

RD-1: Low profile dura-coat cast iron body dome strainer type.

SMITH	ZURN	WATTS	MIFAB	JOSAM
1010Y-ERC-CID	Z-100-ERC-M	RD-300-F-D-K40	R1200-EU-M	21500-22

RD-1A:

SMITH	ZURN	WATTS	MIFAB	JOSAM
1010Y-R-C-CID	Z100-89-RC-M	RD-300-D-K40	R1200-M-B-U	21500-17-22

RD-2: Cast iron body with standpipe. (Specify for use as overflow.)

SMITH	ZURN	WATTS	MIFAB	JOSAM
1080Y-ERC-CID	Z-100-89-ERC-M	RD-300-R-F-B-D-M	R1200-R-EU-M	21500-3-16-22

RD-2A:

SMITH	ZURN	WATTS	MIFAB	JOSAM
1080Y-R-C-CID	Z100-89-RC-M	RD-300-R-B-D-M	R1200-R-M-B-U	21500-3-17-22

2.25 SHOWER ASSEMBLIES

A. General Requirements:

1. All shower and diverter valves and related components shall be concealed within the wall, along with all required supply and outlet piping.
2. Hand held shower slide bars have been omitted.
3. Hand held shower wall brackets shall be used in place of prior specified slide bars
4. Shower heads and hand-held showers shall have maximum flow rate of 1.8 GPM.
5. All showers and diverter valves internal working components shall be constructed of brass or stainless steel. Ceramic disk and/or plastic cartridges of any type are not accepted.
6. Reference Plumbing Standard Technical Drawings P-032 thru P-035 for placement of all ADA shower components.
7. All finish trim components, to include trim plates, flanges, handles, etc., shall be polished chrome of metal material. Plastic components of any type shall not be accepted.

D. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are Haws, Murdoc and Elkay

2.26 SERVICE SINKS and TRIM

A. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are American Standard, Chicago, and Sloan.

SS-1: Cast Iron corner service sink, conforming to Commercial Standard CS 77.63 for acid-resistant enamel, 28-inch by 28-inch, coated wire rim guard, 2-inch flat strainer and rough-plated double faucet with top brace mounted above sink back, furnished with vacuum breaker and hose end.

	CECO	KOHLER	ZURN
Strainer	B-71-2	K-9142	D-2

2.27 SINKS and TRIM

A. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are American Standard, Chicago, and Sloan.

B. Access compliant faucets for sinks: Force to activate controls shall be no greater than 5 pounds. where specified self closing metering to remain open 10 seconds minimum when activated.

C. Cast iron sinks shall be acid resistant enamel, and shall conform to Commercial Standards CS 77.63. Units furnished in conjunction with strainer installation or faucet installation shall be brass. Exposed brass nuts shall be chrome-plated. Refer to the Fixture Supplies paragraph of this section.

D. Exposed trim shall be free from sharp edges or points. Fixture shall be furnished with other listed manufacturer specified trim. Instead of solid supply pipe, polished chrome-plated risers, 3/8-inches outside diameter with ferrule stop end and metal nosepiece may be furnished.

E. For access compliant sinks: Insulate cold water, hot water and drain pipes under sinks with district approved type insulation.

PLUMBEREX	LAV GUARD

2.28 SERVICE STOP GAS VALVES

A. Schedule Numbers:

SGV-1: Bronze/Brass, ¾-inches to 2-inch IPS (WOG) water, oil, or gas – full port ball valve. CSA approved.

(To be specified for larger water heaters, small boilers, pool heaters, and A/C units on roofs.)

WATTS	NIBCO	WILKINS
LFFBV-4	F-510-CS-R-66-FS	Model 850

SGV-2: Cast iron, 2-inch to 4-inch flanged ball valves (WOG) water, oil, or gas. CSA approved.

(To be specified for larger heating equipment.)

WILKINS	NIBCO	WATTS
Model 850	F-510-CS-R-66-FS	G4000M1

SGV-3: Lubricated plug gas valve, 3/4-inch to 2-inch IPS valve.

To be specified for use after gas meter headers, gas regulators, and isolation valves for building isolation, individual floor level isolation, and boiler rooms.)

NORDSTROM	WALWORTH	RESUN
142	1786	1430

SGV-4: Lubricated plug gas valve flanged type 2 ½-inch and larger valve.

(To be specified for use after gas meter headers, gas regulators, isolation valves for buildings isolation, individual floor level isolation and boiler rooms.)

NORDSTROM	WALWORTH	RESUN
142	1786-F	1431

SGV-5: Bronze/Brass ½ inch to 2-inch IPS X Flare Appliance ball valves with Tee handle. Flares to be used in conjunction with corrugated flex lines.

(To be specified for clothes dryer, water heaters, unit heaters, and wall heaters up to 100,000 BTU.)

BRASSCRAFT	NIBCO
TBV 10-12 TBV 8-8 TBV 6-8	GBV 12 GBV 1516

2.29 STOP VALVES

A. Stops shall be loose key type, ½-inches IPS inlet and outlet chrome-plated brass casting, except as noted.

B. Schedule Numbers:

STV-1: Angle:

CHICAGO,	NIBCO
442-LKABCP	77

STV-2: Partition:

CHICAGO	T& S BRASS
1771-ABCP	B-1028

STV-3: Straight Type, with Loose Key:

CHICAGO	T&S BRASS
45-LKABCP (1/2 inch)	B-O418

2.30 TRAP PRIMERS

A. Schedule Numbers:

ATP-1: Automatic, multi-trap primer, cast bronze with access panel. Pressure drop of three p.s.i. shall activate trap seal primers. Manufactured by MIFAB. (Installed in accessible location.)

MIFAB
MR-500-NPB

2.31 URINALS

A. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are American Standard, Kohler, and Sloan.

B. Manual-flush valve: FLV-2.

2.32 WATER CLOSETS

A. General: Water closets shall be vitreous china with Polyvinyl chloride bolt caps. Fixtures with auto-flush valves shall be provided with manual override button.

B. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are American Standard, Kohler, and Sloan.

2.33 WATER HEATERS / DOMESTIC BOILERS

A. Provide as indicated on Plumbing Fixture Schedule: Call out of the schedule is the basis of design. Acceptable manufacturers are Ajax, Rheem and Raypak.

2.34 WATER HAMMER ARRESTORS

WHA-1: Lead Free Water Hammer Arrestor provided for Headers for Lavatories, Wash Sinks, Wash Fountains, Kitchen Sinks, Service Sinks, Urinals and Water Closets. For sizing purposes size according to manufacturer's recommendations.

SIOUX CHIEF	PPP	JR SMITH	WATTS	JOSAM
655 and 656	SC SERIES	5005 TO 5050	Series LF05 and LF15M2	75000

SERIES		SERIES		

2.35 WATER TANKS, HOT – UNFIRED

A. Schedule Numbers: Provide as indicated on Plumbing Equipment Schedule: Call out on the schedule is the basis of design. .

B. Unfired Hot Water Storage Tanks: All welded 1/2 inch thick hot rolled carbon steel plate construction conforming to requirements of ASME Code for Unfired Pressure Vessels (Section VIII of ASME Boiler and Pressure Vessel Code). Tank designed for a working pressure of 125 psig and temperature of 150 degrees F.; tested and coded stamped. Connections shall be 3,000 psi welded extra heavy couplings. Flanged coupling may be furnished on 3 inches or larger connections.

RAYPAK	A.O. SMITH
LOCHINVAR	BRADFORD/WHITE

2.36 YARD BOXES

A. Schedule Numbers:

YB-1 Yard Boxes: 14 3/4-inch by 20-inch by 12-inch, cast concrete, with cast iron hinged locking traffic cover marked "GAS"

(For use over gas stops for portable buildings only, on addition to accessible emergency shutoff valve on building.)

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover

YB-2: Same as YB-1, marked "WATER" (For use over water valves).

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover

YB-3: Same as YB-1, marked "SEWER"

BROOKS No. 36-HFL Assembly with cast iron hinged locking cover

2.37 HEIGHT OF FIXTURES

A. Heights for standard fixtures.

Fixture	Adults and Students (Inches)

Toilets, height to top of seat	15 to 17
Lavatories, sink top height	32
Wash Sinks	30
Urinals, lip height	24
Shower Heads From tip of shower head to finish floor	72
Shower valves	48

B. Heights for access compliant fixtures.

Fixture	Adults and Students (Inches)
Toilets, center line from wall/partition	17-1/2
Toilets Seat Height	18
Lavatories, sink top height	34 maximum
Lavatories, sink knee clearance	27 minimum
Urinals, lip height	16
Urinals, flush handle height	43
Drinking fountains, bubbler height.	36 maximum
Drinking fountains, knee clearance	27 minimum
Wash Sink	Per Drawings
Shower Valves	Per CBC
Shower Seat	Per CBC
Shower Head (adjustable) Bar	Per CBC

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Unless otherwise specified, plumbing fixtures, equipment and appliances that require connections to plumbing line shall be connected. This shall include fixtures specified or indicated as furnished by others, furnished by Owner, or specified in other related sections. Install supplies, stops, valves, traps, wall flanges, or pipe casing for connection of this equipment.

2. Install equipment as indicated on reviewed and accepted Shop Drawings.

3. Avoid interference with Work of other trades. Do not deviate from Drawings without review of the Architect.

B. Examination: Check each piece of equipment in system for defects verifying that parts are properly furnished and installed.

C. For piping Work, refer to Section 22 0513: Basic Plumbing Materials and Methods.

D. Plumbing Fixture and Equipment Installation:

1. Unless otherwise indicated, fixtures shall be installed with 5/16 inch brass bolts or screws of sufficient length to securely fasten fixture to backing, wall, or closet ring.

2. Fixtures installed against concrete or masonry walls shall have their hangers fastened with 5/16 inch brass bolts, Philip Shield type anchors, or 2 unit cinch anchors. Wood or plastic plugs are not permitted.

3. Fixtures installed against wood or metal stud walls shall have their hangers fastened to metal backing plates with 5/16 inch brass bolts screwed into plate. Fixture hangers for urinals shall be fastened centered vertically on metal backing plate with three 5/16 brass bolts each for small individual hangers and six, for larger one piece hangers. Lavatories shall be hung with not less than four 5/16 inch brass bolts or not less than five 1/4 inch brass bolts. Each sink hanger shall be hung with not less than four 5/16 inch brass bolt or not less than five 1/4 inch brass bolts.

4. Pan type drinking fountains shall be hung with 5/16 inch cadmium plated bolts with a bolt in each bolt opening in hanger. Hangers for pan type drinking fountains shall

provide 2 inches (plus or minus 1/4 inch) between pan and wall. Spaces due to irregularities between fixtures and tile walls shall be neatly filled with white cement or silicone filler.

5. Backing for hanging of plumbing fixtures and equipment shall be installed in supporting wall at time rough piping is installed. Backing for stud walls shall be steel plate 1/4 inch thick, not less than 4 inches wide. Backing for urinals shall be ¼-inches thick by 6-inch wide steel plate. Steel plate shall be attached to stud at each end of plate and to each stud it crosses. Plate shall be attached to metal studs by bolting with two ¼ inch U-bolts per stud with bolts through plate and around stud flange or by welding with a 1/8 inch fillet weld full width of stud flange, top and bottom of plate. At wood studs, plate shall be carefully recessed flush with face of stud and attached to each stud with 2 No. 14 flat-head wood screws, 2 inches in length into pre-drilled 1/8 inch holes. Backing for stud walls supporting wall-hung closets shall be as detailed.

6. Rough-in for fixtures, equipment and appliances shall be as indicated on Drawings and as specified, including those items indicated as furnished by others, furnished by Owner, or future capacity. When connections to equipment from capped or plugged lines are required, caps or plugs shall be removed at time equipment is set and stops or valves installed and connections provided as specified.

7. Piping shall be stubbed out to exact location of fixtures and stubs shall be installed symmetrical with fixtures. Hot and cold water supplies for center set faucets on lavatories shall be installed on 8-inch centers, unless otherwise specified or required.

8. Kitchen equipment requiring backflow protection with hot and cold water connections shall be installed with approved backflow prevention assemblies; BPV-3 and drain into floor sink with air gap.

E. Cleanouts in Drain, Waste, Vent and Sewer Lines:

1. Cleanouts shall be installed at locations stated in the California Plumbing Code and accessible at following locations:

   a. At locations above first floor as stated on construction documents and 5 feet outside of the building.

   b. Install an accessible main line upper terminal cleanout in all restrooms above water closet overflow. (Install above upper terminal water closet where there are more than one water closets in a restroom).

   c. Above faucets of each sink with brass plug.

   d. Above service sink with brass plug.

   e. At each Drinking Fountain with brass plug.

f. At each urinal and locate above urinal with brass plug.

g. Above overflow level of pot sinks with brass plug.

h. In vertical line at base of each downspout connected to an underground storm drain system extend cleanout to exterior of building.

i. At upper end of a horizontal vent line when any part of horizontal line is below overflow level of fixture it serves.

j. Not to exceed 100-foot intervals in sewer and waste lines exterior of building.

k. At property line connection.

l. Where indicated on Drawings.

2. Cleanouts shall be extended to grade as follows:

a. Not to exceed 100-foot intervals in straight runs of pipe outside buildings.

b. At horizontal changes of direction in aggregate greater than 135 degrees (underground).

c. At property lines.

d. Where cleanouts occur under concrete.

e. Where marked for future connections.

3. Cleanouts in building shall be extended to floor level or above floor level or above floor level in walls or furring when cleanouts are not accessible or where clearance is less than 18 inches.

4. Cleanouts in finished areas in building shall be concealed except that cleanouts above service sinks in janitor's rooms or closet, and cleanouts above service sinks or in exposed piping in boiler or heater equipment rooms, may be exposed. Cleanouts for urinals shall be installed above urinal and shall terminate behind an access plate.

5. Cleanouts in floors of covered areas and those extended to grade in concrete areas shall be floor level type with extensions body brass plugs and detachable nickel-bronze or aluminum alloy scoriated.

6. Concealed cleanouts in vertical lines shall be service weight soil cleanout tees with brass plugs and round cover plates unless otherwise specified or indicated. A snug fitting sleeve of galvanized sheet metal shall be placed around hub of tee and shall extend to flush with finished soil, or cleanout shall be extended to finished wall.

7. Cleanouts extended from below floor to a wall or furring or on horizontal lines above floor that terminate at a wall or furring shall be iron body type with brass plugs and round cover plates.

8. Cover plates over cleanouts in painted walls shall be steel, bonderized and prime coated. Cover plates cover cleanouts in tile walls shall be chromium-plated brass or nickel bronze. Plates shall be attached to cleanout plugs with 5/16 inch No. 18 or 1/4 inch No. 20 stainless steel vandal-proof type screws. Plates shall be one inch larger in diameter than fitting opening.

9. Cleanouts at bases of downspouts shall be tapped soil tees with brass plugs as hereinafter specified, full size of line.

10. Cleanouts extended to grade in exterior sewer lines other than floors or concrete areas shall be a cleanout assembly with secured top, extra heavy-duty, adjustable sleeve, cut-off ferrule, countersunk threaded brass plug and scoriated tractor type cover.

11. Other cleanouts shall be iron body type.

12. Cleanout extensions shall be no-hub cast iron soil pipe. Exterior cleanouts, those in concrete excepted, shall terminate in a 14-inch by 6-inch thick concrete block with cleanout assembly and top of block flush with finish grade.

13. Fittings in lines utilized as cleanouts shall be approved soil fittings including no-hub pipe. Tees and crosses in vent headers excepted.

14. Pipe joint compound shall not be installed on cleanout plug. After lines are tested and approved, each cleanout plug shall be removed, greased, and replaced.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform trenching, excavation, and backfilling required for Work of this section as specified herein and in Section 31 2323: Excavating, Backfilling, and Compacting for Utilities.

3.04 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and provide proper connections.

B. Potable water lines shall be purged completely before connecting to sources of water for the Project. Determine quality of water supply before connection.

3.05 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on Drawings and in following locations (only non-ferrous arrestors may be installed in copper water system):

1. Water lines to lavatory headers, water closet and urinal headers, service sinks, kitchen sinks, wash fountains, drinking fountains, laboratories with medical type faucets and on wash sinks having three or more stations and all other quick closing fixture such as clothes washers, as close to fixture as possible.

2. Between last two fixtures when three or more fixtures, other than those listed in Number 1 above, are served by a common header.

B. When possible, arrestor shall be installed in wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of arrestor. Access plate shall be a minimum of 2 inches larger in each direction than the arrestor.

C. Fixture water lines shall be provided with mechanical water arrestor hammer dampening devices. Air chambers are not approved.

3.06 CONDENSATE DRAINS - FROM AIR CONDITIONING UNITS

A. Connect drain piping from drain pan of air conditioning unit to condensate disposal location indicated. When coil or unit housing is shock or vibration isolated, connection shall be furnished through a flexible connector not less than 10 inches long. Drain line shall pitch to flow out at not less than one inch in 8 feet. Drain line shall not be reduced smaller than unit outlet connection.

B. Condensate drain piping installed within building whether in air conditioned space or not shall be insulated. Refer to Section 22 0700: Plumbing Insulation, for type of material required.

C. Condensate Trap:

1. A condensate trap shall be installed for each air conditioning coil. Trap shall be assembled from 2 brass unions: one between A/C unit and inlet of trap, and one at outlet of trap that connects to main drain.

2. Trap configuration shall be per manufacturer's recommendations based on total unit casting static pressure (simulated plugged filter condition), but not less than 3 inch water seal.

3. Running trap design is not permitted.

4. Secondary drain shall not be trapped.

D. Condensate trap shall be checked at equipment operational tests for proper water drainage flow from air conditioning unit. Cooling condensate pan shall be filled with water, filters covered with plastic (plugged filter simulated), unit panels replaced, and unit motor running at design condition. Pan shall drain without hesitation to bottom of inlet connection. Tests are made prior to installation of ceiling.

E. Secondary Overflow Drain:

1. Drain pan installed underneath air conditioning units in concealed ceiling space or units that incorporate dam fitting shall be furnished with secondary drain piped to outside planter area with outflow location clearly visible.

2. If outside building location is not available or feasible, secondary drains shall be piped to a classroom sink, if sink is not available pipe to a room corner away from cabinets, computers, desks, door ways/entrances or stairs.

3. Secondary vertical pipe that penetrates through suspended ceiling shall be furnished with a coupling or threaded adapter so ceiling tile can be removed without damage.

3.07 CONDENSATE DRAINS - FROM WINDOW TYPE HEAT PUMP AND EXTERIOR WALL MOUNT HEAT PUMP UNITS

A. Whether indicated on Drawings or not, window units and wall mount units without built in bottom drain pan for evaporator and condenser coils shall be provided with galvanized steel condensate pan at bottom of unit with drain line that drains into approved drywell. Install copper 1/2 inch diameter pipe for window type air conditioners and 3/4 inch diameter pipe for exterior wall-mounted heat pump units.

3.08 MAKE-UP WATER SYSTEMS

A. Provide and connect make-up water systems for equipment in other sections.

3.09 GAS SERVICE

A. Above Grade Service: Pipe shall be steel, hammered, free of dirt and scale, and blown out with oil-free air or nitrogen to a clean, dry condition. Piping shall not be installed in or through a ventilation duct or plenum.

B. Underground Service, Gas approved (yellow) Polyethylene Plastic Pipe: Refer to Section 22 0513: “Basic Plumbing Materials and Methods”.

1. Pipes shall be joined with polyethylene fitting and joined together by thermal fusion in accordance with procedures recommended by Polyethylene plastic pipe and fitting manufacturer.

2. Plastic pipe shall be installed not less than 30 inches below grade.

3. Underground Warning Tape shall be installed 12 inches above buried gas piping. Warning tape shall be yellow with caution statement as follows: “CAUTION – BURIED GAS LINE BELOW”.

4. Plastic pipe shall not be installed in or under a building or structure. Pipe shall be installed under bituminous surfacing or compacted soil area, free from large stones. Pipe may be installed under sidewalks or driveways, as long as no joint

occurs. Pipe installed under paved covered areas wider than 40 feet shall be installed in ventilated conduits extending 2 feet past paving.

5. Pipe shall be installed on a 6 inches deep sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick.

6. Piping shall not support weight of valves, metal fittings or other items. Pipe shall be installed strain free.

7. Plastic pipe fittings shall not be stored or left exposed to sunlight. Pipe in open trenches shall be shielded. A sand envelope of 6 inches minimum shall be placed around pipe, with exception of joints, until inspection by IOR is completed. Protection for pipe shall be provided when necessary to leave pipe exposed overnight.

8. Installer of piping is required to have training and to have attained a certification. Non-trained/Non-certified installer must contact the manufacturer or manufacturer's representative to provide on-site fusion training and certification, prior to work commencement

9. Polyethylene plastic pipe shall connect to a steel epoxy coated anodeless type riser to minimum of 6 inches above grade, when exiting the underground installation and transitioning to steel pipe connection.

10. Where a steel pipe riser passes into a structure or building, a double swing or double-offset joint shall be furnished. Pipe shall pass into structure 6-inches above grade and through a sleeve with a minimum one inch clearance. An isolation valve is required before pipe entering the building.

3.10 CLEANING - PLUMBING PIPING SYSTEMS AND FIXTURES

A. Plumbing lines and fixtures shall be flushed to remove dirt and foreign material until water runs clear and no foreign substance or odor is present. Strainers and screens on faucets shall be removed during this cleaning operation.

B. After satisfactory cleaning of strainer and screen replacements has been witnessed by the Project Inspector, post and maintain signs stating: "CAUTION - Water at this construction project has not yet been certified for human consumption." Signs shall be furnished with letters at least 1/2 inch in height and shall be conspicuously posted at entrances to the Project site. Signs shall be paneled, black and yellow, in conformance with OSHA Section 1910.1455.

3.11 DISINFECTING DOMESTIC WATER PIPING SYSTEMS

A. Newly installed or replaced piping and/or fixtures dispensing potable water, and any additional piping and/or equipment impacting the integrity of this system shall be disinfected and undergo an approved bacteriological analysis before water system is allowed for public use.

B. Disinfection shall commence upon complete installation of all related domestic water systems including fixtures, valves, faucets, water heating systems, etc.

C. Work shall be performed by Technicians Certified by the American Water Works Association (AWWA) and/or the State of California Department Health Services, Grade II Water Treatment Operator Certification or higher issued by the Department of Health Services (DHS) for the State of California. Comply with Title 22, Code of Regulations Division 4, Chapter 13, and Article 2 Operator Certification Grades.

D. Method:

1. A Physical Separation of minimum 6" or Reduced Pressure Backflow assembly shall be installed to protect from cross contamination of the local water purveyor's meter service supply when at any time there is any type of water connection with the piping to be disinfected (Chlorinated) and the water meter service supply.

2. Install a Chlorination Port including a T fitting and a shut off valve to the proximity of the point of connection at the new piping system.

3. System is to be flushed to remove any materials that may have entered the system.

4. Using a chemical feed metering pump and a chlorine tank, the chlorine solution is injected into the water system.

E. Disinfection and De-chlorination procedure (24 or 3 Hour Contact Time):

1. 24-hour Test Method:

a. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated-"Danger Do Not Drink Water" or similar warning.

b. Piping system shall then be adequately flushed with water to remove any particles and eliminate air pockets.

c. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 50 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 50 PPM residual levels.

e. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 24 hours.

f. After 24 hours, chlorine residual levels will again be tested at various points throughout the system to insure a minimum of 25 PPM residual. If the system has not met the minimum of a 25 PPM residual, the above disinfection process shall be repeated.

g. After satisfactory completion of the residual testing, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

h. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

2. 3 Hour Test Method:

a. If the water systems must be turned on for use as soon as possible, a 3 hours chlorine contact time to allow for disinfection is permitted with the OAR's approval.

b. Prior to disinfection, post signs on all water outlets of the system to be disinfected. Sign or tags shall read, "Water System Being Chlorinated-"Danger Do Not Drink Water" or similar warning.

c. Piping system shall be then adequately flushed with water to remove any particles and eliminate air pockets. Using the continuous feed method, sodium hypochlorite conforming to ANSI/ AWWA B300 will be injected into the water system at a minimum of 200 PPM. A water flow meter provided by the water treatment technician will be used to determine the rate of injection and a chlorine test kit, Hach or equivalent, will be used to monitor the residual.

d. Chlorine residual test will be taken at all appropriate points and outlets to verify 200 PPM levels. The chlorinated system shall be shut down for any use and the chlorinated water shall remain in the water system for retention of 3 hours.

e. After satisfactory completion of a 3 hour disinfection period, flush out system until Hach or equivalent test reveal the water outlets have a free chlorine residual concentration less than 0.5 PPM. The procedure shall be in accordance with the AWWA standard C651-05.

f. The OAR may allow temporary use of the water system for construction purposes pending results of the bacteriological test analysis. Sign or Tags shall be left on all outlets stating water system is not safe for consumption until laboratory results are complete and meet these specifications.

F. Bacteriological Test:

1. After final flushing and satisfactory results from the residual free chlorine concentration test, Bacteriological test samples shall be collected. The intent of the following is to provide insurance for an accurate representation to a complete Bacteriological test of the water system. At least two samples shall be taken from each floor of each building.

2. Bacteriological test samples shall be delivered to a State of California Department of Health Services Certified Laboratory to perform qualitative and quantitative bacterial analyses on the water samples for the presence of any Total Coliform bacteria and Plate Count. This count must be less than 500 cfu/mL.

3. The procedure shall be repeated if it shown by bacteriological examination made by an approved agency that the level of Disinfection does not meet these specifications.

4. After satisfactory results for the bacteriological test are provided to the OAR, the physical barrier or temporary reduce pressure back flow devise shall be removed, and the new piping shall be connected to the point of connection. All the connecting piping and fittings shall be disinfected prior to installation. Chlorination Port shall be capped water tight. Warning sign or tags shall be removed.

G. Drinking Fountain and Bottle Filler Lead Test: After installation of Drinking Fountain or Bottle Filler, and successful Bacteriological Test, shut off domestic water supply line feeding the fixture, and inform OAR. OAR will coordinate with the Drinking Water Quality Program (DWQP) Supervisor in local Project Unit and M&O's Plumbing Technical Unit Supervisor to conduct lead detection test and mitigate as necessary. Do not remove related construction warning sign and tags.

3.12 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:

1. Lead free complying with AB1953.

2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

C. Valves shall be accessible and installed within an access panel approximately 3 feet above floor and no more than 7 feet above floor, or in a marked yard box to prevent tampering.

1. Immediately after each water meter, in addition to any valve furnished by utility company, there shall be an accessible valve on the inlet side for a strainer assembly, dual backflow device assembly and/or possibly a dual pressure reducing valve assembly.

2. A gate or ball valve on each water supply before it enters building. Valves shall be accessible from outside building and shall be installed in a marked yard box, unless otherwise indicated on drawings. Ball valves 2 ½-inch size or larger shall omit gate valve handle and furnish 2-inch square operating nut.

3. At multi story buildings, provide an isolation-valve or multiple valves for both hot and cold water in access panel to isolate and control each floor level.

4. For classrooms, shops, offices and boiler or mechanical room, install a gate or ball valve to control hot and cold water lines to each group of fixtures, a group of fixtures shall be considered to be 2 or more fixtures in the same room. When practical, valves shall be installed on the same wall as group of fixtures. Valves shall control only fixtures in rooms in which they are installed.

5. For restrooms, a gate or ball valve shall be installed in each restroom to isolate the hot and cold water supply into a restroom regardless of the number of fixtures. These valves shall control and be accessible only from within the restroom in which fixtures are installed. Valves shall be installed on the same wall as the group of fixtures it serves. Valves shall control only fixtures in restroom in which they are installed. Back to back restrooms shall be isolated separately and individually.

6. Install a gate or ball valve on each building branch line, which serves two or more fixtures, when these fixtures are not provided with a group isolation valve as specified above. These valves shall be located approximately 3 feet but not more than 7 feet above finish floor.

7. Install a gate, ball valve or partition stop for a drinking fountain or a group of drinking fountains.

8. Install a gate, ball valve or partition stop for hot and cold water supply to plumbing fixtures with no accessible supply stops, such as wall mounted faucets.

9. Install a gate, ball valve or partition stop for stops adjacent to, and controlling water flow to each sill cock and hose bib except as follows:

    a. A sill cock immediately below an exterior drinking fountain may be controlled by the same gate, ball valve or partition stop as drinking fountain.

    b. Valves or stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only hose bibs and branch line is furnished with a shut-off valve.

10. Install a lose key angle stop, on each exposed fixture supply, and for each flush valve unless otherwise specified,

11. Install gate or ball valve at each location where a water line is connected to a piece of equipment other than items mentioned above.

12. Install a check valve on each hot water return line where it connects to a hot water storage tank or a water heater.

13. Handles, hand wheels (including dishwasher fill valve handles) and operating nuts shall be furnished of steel, brass, or cast iron and shall be removable. Unless specified to be loose key type, handles shall be securely fastened to their stems. On exposed outdoor valves, omit operating handles and provide operating nuts.

14. Provide a handle or a key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver them to the project OAR.

3.13 VALVES - GAS SERVICE

A. A gas readily accessible shut-off stop shall be installed on each gas line entering a building immediately prior to the point it enters the building. Unless otherwise specified or indicated, shut-off valves for lines entering a permanent structure, buildings or portable buildings, shall be installed in a vertical riser above grade.

1. Gas shut off valve for portable buildings – In addition to the gas readily accessible shut-off stop specified above, a dedicated Gas shut off valve shall be provided in a marked Yard Box, for each portable building to facilitate relocation/removal of building without the need to shut off gas to entire campus.

B. Gas Shut off valve within a building – A gas shut off valve with handles shall be accessible and serviceable within an access panel. Install valve minimum 3 feet above floor but less than 7 feet above floor.

C. In addition to locations specified, gas shut off valve shall be installed at following locations:

1. Install a lubricated plug gas shut off valve on any line connected to gas main or header at master assembly.

2. Install a lubricated plug gas shut off valve before entering any building or structure.

3. Install a gas valve on each outlet, in addition to any gas stop furnished with equipment.

4. Service to laboratory gas cocks shall be furnished with a special precision check valve, located downstream from gas stop servicing room outlet at each laboratory cock. Unless otherwise specified, 1/8-inches bore shall be provided for each outlet cock.

5. Install a gas shut-off valve on each gas line serving 2 or more gas outlets in same room. Service stop shall be installed not more than 7 feet above floor, and shall be in the room it serves.

6. Install a gas shut-off valve on inlet side of each gas pressure regulating valve.

7. Gas shut-off valves to be furnished with equipment.

8. Install gas shut-off valve at not more than 1,000 foot intervals on each gas main.

9. At multi-story buildings, provide gas-shut off valve(s) to isolate and control each floor or level. Install valves in a concealed manner in walls with access panels.

10. Gas shut-off valves in classrooms and locations subject to tampering shall be protected while remaining accessible.

D. When a gas-shut off valve adjacent to gas-fired equipment is indicated in Contract Documents it shall be furnished and installed as part of Work of this section.

E. When electrical wall switches with emergency push button are specified for controlling gas outlets at Laboratory Classrooms, provide main shut-off gas valve with normally closed electric solenoid valve within an accessible access panel.

3.14 ELECTROLYSIS PREVENTION

A. Brass nipples, 6 inches, with recognized brass unions; flanges shall be furnished and installed at locations described herein. Flanges shall be installed with complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at following locations:

1. Where special applications indicated on Drawings require an insulation flange or brass union, with 6-inch brass nipple to be installed in a condensate line, or steam line, flange insulation shall be of a high temperature type, suitable for continuous operation at temperatures up to 220 degrees F. for condensate and 400 degrees F. for steam.

2. Where steel or cast iron in ground connects to copper or brass piping above ground, transition from steel or cast iron pipe to copper or brass pipe shall be provided in an accessible location.

3. Underground dielectric connections shall be furnished in accessible yard boxes.

4. Above ground dielectric connections shall be exposed; or if in finished rooms shall be located in accessible access boxes.

3.15 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished according to Section 22 0553: “Plumbing Identification”

B. Underground Caution Tape shall be placed 12 to 18 inches above the utility line. The Caution Tape shall be a designated color and marked with the appropriate name for the specific type of utility pipe as follows:

1. Yellow – with the words: CAUTION GAS LINE BELOW

2. Blue – with the words: CAUTION WATER LINE BELOW

3.16 HOT WATER CIRCULATING PUMPS

A. Floor-mounted pumps shall be provided with a 4-inch high concrete base with ½ inch reinforcing bars at 12-inch centers each way and doweled into concrete floor.

B. Piping shall be supported from building structure so as to prevent any strain on pump casing.

C. In-line pumps, unless otherwise specified, shall be centrifugal type with non-overloading characteristics and shall not overload motor above its horsepower rating under operating conditions with ratings based on continuous operation.

D. Centrifugal water pumps shall be rated according to Hydraulic Institute Test Code for Centrifugal Pumps. Pumps shall be furnished with bronze water chamber, bronze impeller and mechanical seal. Rotating parts shall be statically and dynamically balanced.

E. Flanged connections shall be provided on pumps with discharge connections larger than 2 inches. Smaller sizes may be threaded connections.

F. Hot water circulating pump shall be arranged so that pump can be automatically turned off when hot water system is not in operation.

3.17 WATER TEMPERATURE CONTROLLERS

A. Furnish and install a water temperature controller in hot water line adjacent to, and for control of, circulating pumps on hot water return lines when said pump is indicated on Drawings or herein specified. Bulb of temperature controller shall be installed so as to be directly in path of flowing water and so as not to obstruct flow of water.

B. Furnish and install a water temperature controller in hot water storage tanks for control of circulating pump on hot water circulating line when said pump is indicated on Drawings or specified herein.

3.18 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.19 BACKFLOW PREVENTION DEVICES

A. Backflow Devices: Installation of backflow devices shall be tested and certified by Los Angeles County backflow device tester before Substantial Completion. Tests shall be performed in presence of Project Inspector. Test reports shall be turned over to Project Inspector for mailing to proper agency.

3.20 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose off Project site.

3.21 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

DIVISION 23

HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SCOPE: Work includes but is not necessarily limited to the following:

A. All applicable requirements of Documents 0 and Division 1 - General Requirements apply to the work of this Section.

B. Examine all other sections for work related to those sections which are required to be included as work of this section.

C. Section Includes: Heating, Ventilating and Air-Conditioning. Provide all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work in this Section. Complete, as shown on the Drawings and/or specified herein, including but not limited to these major items:

1. Split system air cooled heat pumps and exhaust fans.
2. Air distribution systems for air conditioning, ventilation and exhaust. Systems to be complete with access doors, dampers, diffusers, registers, grilles and all required accessories.
3. Hangers and support for ductwork and equipment.
4. Automatic control systems.
5. Thermal and acoustical insulation for plenums, piping, and ductwork.
6. Subzone systems.
7. Smoke detectors.
8. Air filters.
9. Vibration isolator.
10. Service and equipment connections.
11. Pipe hangers and supports.
12. Testing and balancing of systems.
13. Miscellaneous items including instruments, equipment supports, flashings, access panels, sleeves and plates, testing and adjusting, and all accessories and items required for a complete installation.
14. Permit and related fees.

D. Related Sections: Document affecting work of this Section include, but are not necessarily limited to general conditions, supplementary conditions and Sections in Division 1 of these Specifications.

1. Electric relays, switches and wiring for heating, ventilating and air conditioning equipment except where otherwise designated on control diagrams in Division 26 - Electrical.

2. Furnishing and installing control and starting equipment, including transformers and motor starters not furnished with equipment specified in Division 26 - Electrical.

3. Condensate drain lines, including connections to equipment in Division 22 - Plumbing.

4. Access Doors and Frames - Section 08 31 16.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Conform to applicable City and State Building Codes and Ordinances.

1.3 GENERAL REQUIREMENTS - See Division 1

A. Location: Indicated on the drawings. For purpose of clarity, the drawings are generally diagrammatic, omitting offsets and small details. Certain duct runs are shown distorted to avoid confusion. Where locations are fixed by dimension notations, follow as closely as possible consistently with proper installation.

B. Exact Locations: As required for proper installation avoiding interference with architectural and structural features, work of others to preserve head room and to keep openings and passageways clear. Make arrangement neat and occupy minimum space.

Install each item of equipment so as to allow for ease of maintenance and in accordance with all governmental requirements having jurisdiction.

1. Locate ceiling diffusers symmetrical with respect to room center lines, electric lighting fixtures and acoustical tile. Arrange the exact locations in coordination with installation of lighting fixtures and acoustical tile; as indicated on the reflected ceiling plan on the drawings subject to the approval of the Architect.

C. Openings: Provide through walls, floors, partitions, and other construction as necessary for passage of ducts whether indicated or not on the Drawings. Seal around all penetrations.

D. Cutting and Repairing:

1. Cutting: Do not cut structural members without written authorization by the Architect.

When permitted, provide all reinforcement with repair as directed by the Architect.

Provide openings through walls, floors, partitions, and other construction as necessary for passage of pipes, conduit, and ducts whether or not such openings are shown on the Contract Drawings.

2. Repairing: By appropriate craft persons to restore construction to a condition approved by the Architect. Seal around all penetrations.

E. Protection of Work: As necessary to prevent damage of any kind to materials and installation.

F. Record Drawings: Provide accurately scaled locations, all control equipment, ducts,

temperature control apparatus, volume dampers as installed, in strict accordance with provisions of Division 1 of these Specifications.

G. Submittal Shop Drawings, Manufacturer's Data and Lists of Materials, Fixtures, Equipment and Control Diagrams:

1. General: Submit for approval, in accordance with provisions of Submittals Section of Division 1 of these Specifications, to ensure ample time for checking and processing of the submittals by the Architect; delays resulting from improper and untimely submittals shall be the responsibility of the Contractor.

2. Required List of Materials, Fixtures, and Equipment: Complete with names and addresses of manufacturer's, catalog numbers, trade numbers, trade names, illustrations, and descriptive literature for each article proposed to be used in this project. Descriptive literature to be sufficient for complete evaluation of equality of the proposed articles. All pertinent data for each article shall be underlined in each copy of each catalog or brochure in which it is described.

3. Required Control Diagrams: Complete ladder diagrams to show internal wiring of all major components and complete schematic control wiring diagrams, sequence of operation, and interlock of all associated equipment for each system to be drawn by Control manufacturer or A/C unit manufacturer and accompanied by a description of control sequence; to be submitted to be approved by the Architect before installation of any control wiring or equipment; without fulfillment of this requirement, control diagrams will not be approved.

4. Approval of shop drawing or other submittals will be general and shall not relieve the Contractor from the responsibility for proper fitting and construction of the work, nor from furnishing materials and work required by the Contract which may or may not be indicated on the shop drawings when approved as specified in Subsection 1.3(G) of this Section.

5. Disapprovals: Omit any article disapproved by the Architect not conforming to specifications or not of proper quality or grade and provide suitable article(s) in lieu thereof in conformity with the specifications. Start no construction work or purchasing related to such article(s) prior to approval.

6. Approved List: To be used for procurement without deviation, unless otherwise authorized by the Architect.

7. Modification of Contract Drawings: In each case where proposed substitute materials or equipment will require, for proper installation, changes to the design of the project as indicated on the Contract Drawings, appropriate proposed revision drawings shall be prepared by a licensed Architect or Engineer and shall be furnished by the Contractor for approval by the Architect. Letter of transmittal shall indicate all variations in performance, design, and installation between proposed substitutes and the specified items; each article in submittals will not be accepted unless identified with reference to Section and/or Subsection number of this Specification. Such drawings to be sufficiently complete for proper installation of the proposed substitute materials or equipment and for construction by all interested trades of the proposed revisions to the project. The cost of the drawings and of the proposed revised construction shall be borne by the

Contractor. Submit any proposed substitutions and any necessary deviations or changes to control diagrams to the Architect in accordance with Division 1. Contractor shall state in writing when such item is submitted as a "substituted item."

H. Materials and Workmanship:

1. General: In conformity with City Plumbing and Mechanical Codes, Underwriters' Laboratories, CAL/OSHA Standards, SMACNA Standards, State Energy Standards Title 24, and State Fire Marshall requirements.

2. Materials: New and in perfect condition. Materials for similar uses to be same type and manufacture unless otherwise approved; sheet iron or steel and fastenings to conform to requirements specified in the Division 1 of these Specifications. All heating and cooling equipment shall be listed items by California Energy Commission.

3. Workmanship: In accordance with best trade practices and as noted in Subsection 1.2A of this Section.

I. Permits and Inspections:

1. Permits: As required by Mechanical Codes; to be obtained and paid for by the Contractor except permits and costs otherwise provided for in these Specifications.

2. Inspections: Required of all installations prior to concealment and completion of the work; by the City Department of Building and Safety. Final Certificate of Approval required for the entire heating, ventilating, and air conditioning systems. See Division 1 for required permits.

J. Discrepancies or Errors: Should they appear in the drawings, specifications, approved shop drawings, or in other Contract documents, the Contractor as directed in Division 1, shall immediately notify the Architect and ask for instructions.

K. Maintenance and Operating Manuals: Provide maintenance and operating manuals for all equipment; include control diagrams with description of sequence of operation, as per provisions of Division 1 of these Specifications.

L. Acceptance of heating, ventilating, and air conditioning system will not be considered until the Contractor has completed balance, test and adjustment of all mechanical systems and all other work as hereinafter specified, including all testing work, and has demonstrated to the Architect that all such systems operate properly in accordance with these Specifications and the standards herein referenced.

M. Test and Supervision: As indicated in Division 1.

1.4 SUBMITTALS

A. Comply with provisions of Division 1.

B. Shop Drawings: Furnish detail shop drawings or catalog plates of all special equipment as required for approval. Shop drawings or catalog plates shall show sizes, sections and dimensions of equipment, methods of connection or attaching to work of other trades, and copies of all shall be furnished to other trades. Make all erection drawings necessary for the installation of the work.

C. Material List:

1. Before entering into any Contract for purchase of materials, and before any work is started, Contractor shall submit for approval, including catalogs and descriptive matter, of the following materials and equipment he proposes to furnish and install. Materials list shall be complete and contained in the hard-bound loose-leaf notebooks. Items not contained in the submittal shall conform to design specifications as supplemental submittals will not be accepted. Submittals shall include but not limited to the following:

   a. HVAC equipment.
   b. Ductwork and accessories.
   c. Each register, diffuser, and manufactured plenum with reference to schedule number.
   d. Wiring diagrams of electrical connections required for installation of equipment.
   e. Temperature control system with a detailed description of the control sequence, etc.
   f. Certified performance curves for all fans.
   g. Subzone systems.
   h. Smoke detectors.
   i. Air filters.
   j. Insulation.
   k. Vibration isolators.
   l. Seismic restraints.
   m. Exhaust fans.
   n. Air balance procedures and forms.

D. Wiring Diagrams: Wiring diagrams of work required for the installation of the ventilating and air conditioning equipment shall be submitted for approval. Only approved diagrams shall be used for installation purposes.

E. Tests and Balancing:

1. One week prior to final inspection submit to the Architect bound and indexed copies of the report on system operation, including air quantities at each outlet and fan, fan speeds, pulley and motor sizes, motor loads and all other pertinent data.

1.5 CODES, ORDINANCES AND CONDITIONS

A. All work shall conform to, and be installed in accordance with, the requirements of all laws, rules and regulations of the State, City, and County. Requirements of this Section are minimum requirements and shall govern, except that the building laws and/or the Drawings shall govern when their requirements are greater or more stringent, without added cost.

B. Where the work as shown on the Drawings or described in the Specifications is in conflict with any of the laws, ordinances or regulations applicable to this project, the Contractor shall notify the Architect and obtain directions before installing any of the work involved with the conflict.

C. Examine all other Sections for work related to those Sections and required to be included as work under this Section.

1.6 PRODUCT HANDLING: Comply with pertinent provisions of Division 1.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. Description: The sheet metal shall include housings, ductwork, plenums, dampers, equipment connections, etc.

B. Materials: Sheet metal shall be fabricated of galvanized steel sheets of lock forming quality (LFQ) and shall have a galvanized coating of 1-1/4 oz. total for both sides of 1 sq. ft. of a sheet. Supports not part of ducts, bar or angle reinforcing, damper rods and items made of uncoated mild steel shall be painted with two coats of primer.

C. Construction: Sheet metal ductwork may be of either rectangular construction (steel or aluminum) or round construction (only spiral seam steel). Gages as per local code requirements; fabrication shall be in accordance with the Sheet Metal and Air Conditioning National Association (SMACNA) HVAC Duct Construction Standards - Metal & Flexible, 3rd Edition - 2006, and as hereinafter specified.

D. Elbows and Tees: Shall have a center line radius of 1-1/2 times duct width, measured in plane of turn. All square elbows shall be equipped with turning vanes of double-thick metal of air foil design. Vanes shall be straight, and securely fastened to the sides. Square elbows with radius heel will not be permitted.

E. Extractors where Required for Proper Air Flow: Adjustable volume type with extended flexible shaft, connected to grille face or to side of duct permitting adjustment from exterior or duct.

F. Manually Operated Dampers or Splitters: Fabricated of 16 gauge steel, and as recommended by SMACNA Manual, equipped with Vent-Lock #637 self-locking regulator or equal on all ducts unless noted otherwise. Provide where required for air balancing, including O.S.A. intakes. Single leaf damper approved up to 36" x 12" maximum duct size, over these sizes multi-blade opposed type damper shall be used.

G. Joints and Seams Metal Ductwork: Seal all field joints and seams airtight with "Hardcast" or canvas and "Arabol" or approved equivalent. Ductwork exposed to weather shall have all joints sealed with canvas and "Arabol".

H. Kitchen Exhaust Ductwork: Ductwork shall be galvanized steel of 20 gauge. Duct shall be installed as per hood manufacturer's instructions. Connections to hood shall be by this Contractor.

I. Dryer Vent Duct: Ductwork for dryer vent shall be smooth, rigid galvanized 26 gauge with adjustable elbows, dirt leg and removable cap at dryer, and no screws or other extension into the air stream. Maximum 14'-0" length and two 90° elbows, for 4" round ducts. A 2' ft. long metal flexible duct connector is allowed at the dryer.

2.2 FLEXIBLE AIR DUCT AND CONNECTORS (MAX. 5 FT. LONG, UNLESS NOTED OTHERWISE)

A. Flexible duct shall be factory fabricated assembly consisting of a zinc-coated spring steel helix in sealed double layer vinyl inner liner, wrapped with a nominal 1-1/2" (R-6.0) thick fiberglass insulation and sheathed in a metal foil vapor barrier jacket. The composite assembly, including insulation and vapor barrier shall meet the Class 1 requirements of flame spread of 25 or less, smoke developed of 50 or less, as set forth in NFPA Bulletin No. 90-A and be labeled by Underwriters Laboratories, Inc., as an air duct.

B. Flexible duct shall be maximum 5' length, sizes as required by contractor documents and have galvanized sheet metal male and female end-connectors. End-connectors shall be attached to

each other or to other sheet metal fittings with (4) No. 8, 3/8" sheet metal screws spaced approximately 90 deg. apart, or with a ½" wide metal band screw type clamping device. All metal fittings used with the flexible duct shall be insulated with a 2" thick, 1-1/2 lb. density flexible blanket insulation, jacketed with a foil face vapor barrier and sealed per CEC approved method to provide a continuous seal and a neat workmanlike appearance.

C. Provide a manual damper at each take-off connector.

D. Flexible duct shall be Thermaflex U/L Class 1 rated air duct or approved equivalent.

E. Install in strict accordance with Code requirements and Manufacturer's instructions.

2.3 REGISTERS AND GRILLES

A. All registers and grilles shall be furnished with finish as per architect. Extruded aluminum to be treated for painting unless otherwise specified or noted.

B. The manufacturer shall verify that all supply and return selections shall not produce an ambient noise level in excess of NC-30. Only the self-noise of the outlet shall be considered.

C. Shop drawings are required for each type register and manufactured plenums, with reference to schedule number.

D. All registers and grilles shall be furnished with neoprene gaskets.

E. Grille and Diffuser by: Titus, Krueger, Anemostat, Metalaire.

F. Description: As per schedule on Drawings, sheet M1.105.

2.4 ACOUSTICAL AND THERMAL LINED DUCTS

A. Material: 1" thick flexible glass fiber, 1-1/2 lbs. per cu. ft. density, blanket type duct liner. Lining must be approved by local codes and shall be approved by local codes and shall meet or exceed NFPA Standards. NRC rating shall be at least .080 at frequencies above 1000. R-6.0 minimum.

B. Manufacturers: Johns Manville 'Line-Coustic A' duct liner, Owens-Corning 'Aeroflex' or approved equivalent.

2.5 THERMAL INSULATION, WRAPPED (DUCTWORK)

A. Material: Glass fiber blanket of not less than 1-1/2 lb. Per cu. ft. density. 2" thick on return and supply ducts. Duct insulation to be provided with foil face vapor barrier. R-6.0 minimum indoors.

B. Manufacturers: Manville 'Microlite', equivalent by Owens-Corning or approved equivalent.

2.6 VIBRATION AND NOISE CONTROL

A. All mechanical equipment shall be isolated from the structure by means of resilient vibration and noise isolators, supplied by a single manufacturer to the mechanical contractor.

B. Earthquake Restraints: All base mounted equipment shall be equipped with seismic snubbers.

Snubbers shall be capable of withstanding a horizontal force equal to 1 g., and a vertical force equal to ½ g.

2.7 EXHAUST FANS

A. Ceiling or Wall Exhaust Fans:

1. Package ceiling or wall mounted centrifugal fan complete with motor, sound insulation, housing, pre-wired outlet, box, vibration isolators and backdraft dampers. Provide roof jacks or roof caps as required.

2. Capacities as scheduled on Drawings, maximum 2.5 sone for toilets. Maximum 5.5 sone for utility areas.

3. Manufacturer: Panasonic, Air King, Cook or approved equivalent.

2.8 SPLIT SYSTEM HEAT PUMP HVAC UNITS

A. Outdoor Heat Pump:

1. Contractor shall provide air-to-air electric, R-410A “Puron,” heat pumps with built-in outdoor coil and compressor sections. Capacities shall be as required to maintain design conditions. Factory installed coil refrigerant metering device shall be mounted on liquid service valve and reversing valve. Condenser fans shall be direct-driven and arranged for horizontal air discharge. Fan motor shall be factory lubricated, inherently protected and resiliently mounted.

2. Compressor shall be hermetically sealed scroll type with internal vibration isolators and provided with sound attenuating device. Compressor motor shall include all thermal and current-sensitive overloading devices. Compressor shall be equipped with a crankcase heater and shall have internal high-pressure protection. Controls shall be factory wired in a readily accessible location.

3. Controls shall include a liquid line low pressure switch, suction line accumulator and pressure relief device. Control wiring terminal board shall be designed to match indoor unit terminal board and accessory automatic changeover thermostat terminals for standardized point-to-point connection.

4. S.E.E.R. & H.S.P.F. must comply with Title 24 requirements. See equipment schedule.

5. Accessories shall include automatic changeover thermostat, solid-state time guard, liquid line Biflow filter-dryer and solenoid and refrigerant tubing length as required. Where required, provide manufacturers stacking kits.

6. Manufacturer: Carrier Alternate manufacturers for equal capacities, weights and electrical characteristics shall be preapproved.

B. Indoor Fan Coil Unit:

1. Contractor shall provide direct expansion R-410A “Puron” heat pump fan coil units equipped with check and expansion valve kit, as shown located on floor plans and schedule. Unit shall be horizontal discharge type. Unit enclosure shall be insulated and constructed of galvanized steel, bonderized and finished with baked enamel. Service access panels shall provide access to all components. Filter rack shall be equipped with 1" thick Farr disposable MERV 8 filters that slide out for maintenance.

2. Fan shall be forward curved with double inlet, mounted on motor shaft, dynamically and statically balanced. Cooling coil shall be non-ferrous with aluminum plate fins. Coil shall have factory-installed refrigerant metering device, refrigerant line fittings

which permit mechanical connections; and condensate pan with primary and secondary drain connections as well as an emergency float switch.

3. Accessories: As scheduled on drawings.

4. Manufacturer: Carrier. Alternate manufacturers for equivalent capacities, weights and electrical characteristics shall be preapproved equivalent.

2.9 REFRIGERANT PIPING AND ACCESSORIES

A. All refrigerant piping shall be Type "L" copper.

B. Refrigerant piping shall be made up of wrought copper or forged brass designed for refrigerant piping and for use with "Silfos" high-temperature solder. No joints are allowed in inaccessible locations.

C. Hangers on insulated refrigerant piping shall fit outside covering. Provide covering protection saddle 10" long at each hanger. Rigid insulation shall be provided at all hangers to prevent crushing.

D. Provide Semco trisolators at all hangers of uninsulated piping.

E. Provide vibration eliminators with braze-welded female ends, approved for refrigeration piping.

F. Drier: Sporlan silica gel replaceable core sized for compressor capacity with bi-flow for heat pump duty, approved equivalent Henry or Alco.

G. Liquid indicators double ported installed in lines at cooling coil inlets. Manufacturer: Henry or Alco.

H. Shut-off valves shall be balanced action packless type for lines sized 1-1/8" O.C., or smaller, and wing cap packed bronze valves with bolted bonnets, repackable under pressure by Henry.

I. Expansion Valves: Pilot operated piston type with manual operation stem by Henry or Alco.

J. Solenoid valves shall be Henry or Alco.

K. Installation: Dehydrate complete system and test thoroughly for leaks before initial charge is placed in system. Special care shall be taken for abnormally long piping runs in excess of 50 feet. Consult manufacturer of A/C equipment for installation requirements and restrictions.

L. Refrigerant and Oil: Contractor shall furnish and charge the system with the necessary charge of refrigerant, together with all the oil necessary to operate the system. Sufficient refrigerant shall be supplied to fill the system for proper operation.

M. Guarantee: Replace at no cost to the Owner all refrigerant and oil lost due to leaks or faulty materials and workmanship for a period of one year after date of acceptance.

N. Insulate suction lines including fittings, with "Rubatex" flexible elastomeric tube insulation. Seal all seams and joints with Rubatex 373 adhesive, 0.25 "K" value maximum. 3/4" thick on pipe 1-1/2" and smaller. Provide UV protective coating on insulation exposed to atmosphere.

2.10 AIR FILTERS

A. MERV 13 Efficient - Medium efficiency pleated disposable type, size as required by air handling unit. Filters shall be provided with media support grid, enclosing frame. Filter shall be FARR Air UL, Class 2 (30/30) or approved equivalent.

B. Replacement Filters: All systems shall have specified filters installed prior to testing and balancing: All filters shall be replaced at the time the building is turned over to the Owner.

2.11 THERMOSTATS

A. Shall be remote, microelectronic chronotherm heating/cooling type with separate temperature sensing elements for each system. Heating and cooling circuits shall be electrically isolated from each other. The heating side shall be provided with a factory set maximum of 75 degrees F. The thermostat shall contain or be provided with sub-base containing selector switches for cool-off heat and fan-auto-on.

B. Low voltage digital clock type with programmable set points for automatic operation, one or more times per day.

C. Manufacturer: Honeywell or approved equivalent.

2.12 ELECTRICAL MOTORS

A. General: Motors rated less than ½ HP shall be wound for 115 or 240 volt, 60 hertz, single-phase current. Motors rated ½ HP and over shall be wound for 240 volt, 60 hertz, 3-phase current, unless noted otherwise. If exposed to weather or moist atmosphere, all enclosures shall be drip-proof and epoxy encapsulated unless otherwise specified.

B. Single Phase Motors: NEMA Standard for fractional HP motors. Built-in overload and low-voltage protection with reset button on motor is required.

2.13 AUTOMATIC CONTROL DEVICES

A. Furnish all the automatic temperature control devices.

B. The control equipment shall be as indicated on drawings.

1. Instruct the electrician, or sheet metal worker on the particular requirements of the control devices for which each is responsible.

2. Calibrate all devices and make all final settings and test out the control system under actual operating conditions for satisfactory operation.

C. Wiring: All line voltage conduit and wiring in connection with the control system is specified under "Electrical" Section.

D. Thermostats: Low-voltage electric type and self-generating multivolt room thermostats complete with set point adjustment. Mount 4'-0" above floor.

1. See control diagram on drawings for fan controls.

2.14 MACHINERY GUARDS

A. Cover all moving parts of machinery such as shaft couplings, belt drives, exposed fan intakes, etc., with removable metal guards. Provide access in guard for tachometer readings. Comply with applicable safety regulations.

PART 3 -EXECUTION

3.1 STEEL SHEET METAL WORK

A. Sizes shall be as noted on Drawings, to provide quiet draft-free ventilation.

B. Slope: No more than 1 to 7 on any side except where connections dictate. A maximum of 1 to 4 may be used, subject to approval.

C. Throat: Area of the branch duct takeoff shall be in direct proportion to the volume of air to each branch.

D. Holes: Holes in duct for damper rods and other necessary devices shall be drilled and shall be airtight. No pipes, conduits or other member may pass through any duct unless otherwise shown on the Drawings.

E. Noise: Entire system shall prove quiet to a degree satisfactory to the Owner. Any adjustment required to produce quietness shall be made by the Contractor before work can be deemed to be finished and accepted.

F. Isolation: Where incompatible materials come in contact, they shall be isolated from each other with rubber, neoprene, lead or material best suited for the materials to be isolated.

G. Supports: Secure ducts against displacement and vibration. Anchor to structural parts of the buildings at intervals not greater than 10 feet. Suspend with 18 gauge straps and as recommended in the SMACNA Manual.

3.2 MECHANICAL INSULATION

A. All ductwork, equipment and appurtenances handling air at temperatures above or below room ambient shall be insulated as generally described herein.

B. Installation shall be neat and workmanlike in appearance and quality of workmanship.

Insulation shall be neatly cut at supports, etc., and shall be first class in workmanship. Installation shall be in direct compliance with manufacturer's recommendations for his particular materials. Care shall be taken during installation to eliminate or reduce dust and dirt to a minimum. Waste and debris shall be removed as it accumulates.

C. Where ducts are lined on the interior, no external insulation is required.

3.3 INSTALLATION OF DUCTWORK

A. Fabricate and install ductwork in strict accordance with Mechanical Code Chapter 6, and SMACNA standard.

B. Sheet Metal Ductwork:

1. Cross-break, or kink flat surfaces to prevent vibration.

2. Wherever obstructions require a change in duct shape, maintain equivalent areas. Sizes indicated on Drawings are sheet metal sizes allowing for the lining.

3. Connections:

a. Install and make necessary connections for the complete supply, recirculation and exhaust systems including ductwork, air distribution device, collars, intake housings, hangers, connections, fasteners, and other items required.

b. All air supply and return air ducts shall have their longitudinal and transverse seams tightly sealed to provide an airtight system.

C. Provide flexible canvas connections between units and ductwork, minimum 3" wide.

D. Volume Dampers:

1. Provide adjustable volume dampers in branch supply and return ducts.
2. Locate the dampers as close as possible to the main duct.
3. Provide remote operators where dampers are inaccessible.

E. Debris Protection: Prior to any interior sanding or finishing of the Apartments, provide covers for all duct inlets and outlets to prevent any debris, dust or paint from inadvertently getting into the duct system. If the systems are to be in operation during the construction, provide temporary extra high-quality filters on the systems. Remove these filters at the time of Testing & Balancing and turn them over to the Owner. Also provide protection for the HVAC equipment that is on site during the construction period.

3.4 NOT USED

3.5 FLEXIBLE AIR DUCTS

A. Flexible duct shall be sized as required by calculations, and have galvanized sheet metal male and female end connectors. End connectors shall be attached to each other or to other sheet metal fittings with four #8, 3/8" sheet metal screws spaced approximately 90 degrees apart; or with a ½" wide metal band screw type clamping device.
B. Flexible ducts shall be installed in a fully extended condition free of sags and kinks, using only the length required. Where, in the opinion of the Architect, flexible duct length is excessive, the duct shall be shortened or replaced with a flexible duct of suitable length. The flexible duct bending radius shall not exceed the specific manufacturer's UL approval. Where horizontal support is required, flexible duct shall be suspended on 36" centers with a minimum 2" wide flat banding material. Provide “Flex Flow Elbows” at all elbows over 45°, manufactured by “Therma Flex,” 1-800-459-4822.

3.6 ELECTRICAL WORK

A. Disconnect switches, line voltage wiring and all conduit (power line and low voltage) are specified in the Electrical Section of the Specifications unless otherwise specified and/or noted on Drawings.
B. Wiring diagrams of electrical connections required for the installation of equipment of this Section shall be submitted to the Owner for approval. After approval, the wiring diagrams shall be submitted to the Electrical Contractor for use in installation.

3.7 PAINTING

A. Painting of all apparatus, unless hereinbefore specified, shall be done under the Painting Section of the Specifications. All apparatus furnished by the Contractor shall be provided with a shop coat at the factory. Inside of ducts behind all air inlets and outlets in finished areas shall be painted two coats of dull flat black by this Contractor. Certified low V.O.C. rating.

3.8 EQUIPMENT IDENTIFICATION

A. Identify all equipment, using brass discs or black with white engraved letters laminated plastic. Install in readily visible location, not interfering with insulation.
B. Fans, Air Conditioning Units, Pumps, Etc.: Laminated plastic showing manufacturer, HP,

capacity, static pressure and electrical characteristics.

3.9 TESTING AND BALANCING

A. General:

1. Test, balance and adjust the ventilating systems as specified herein. All work shall be done under direct supervision of a qualified engineer or contractor. All instruments used shall be accurately calibrated and maintained in good working order.
2. Balancing and testing shall not begin until systems have been completed and are in full working order. Put all ventilating systems and equipment into full operation during each working day of testing and balancing.
3. Perform the following tests, compile the test data and submit 2 copies of the complete test data to the Owner.

B. Air Testing Procedure: Perform the following tests and balance system, including air distribution devices provided by the ceiling Contractor, in accordance with the following requirements, but not limited to:

1. Test and adjust blower RPM to design requirements.
2. Test and record motor full load amperes.
3. Make pitot tube traverse of main ducts and obtain design CFM at fans.
4. Test and record system static pressures, suction and discharge.
5. Test and adjust system for design recirculated air, CFM and temperature.
6. Adjust all main supply and exhaust air ducts to proper design CFM.
7. Test and adjust each grille and register to design CFM requirements.
8. Manufacturer's ratings on all equipment shall be used to make required calculations.
9. Readings and tests of grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
10. Make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by the air balance agency, at no additional cost to the owner.

C. Upon completion of the balance of the system, all the information shall be inserted on a sheet listing all items required by Specifications and be included in complete test and balance report and then shall be submitted for approval.

D. The Owner reserves the right to request the Contractor to readjust air volume and different systems requirements to meet local conditions during the six months following, after completion of the total balancing of the systems. During this time, the Engineer, at his discretion, may request a recheck or resetting of any outlet, supply air fan, or exhaust fan or any other equipment or part of as listed in the test report. Contractor shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

3.10 CLEANING

A. Completely cover motors and other moving machinery to protect from dirt and water during construction. Cap all openings into ducts and pipes to protect from foreign matter while under

construction.

B. Thoroughly clean inside of ductwork before installing grilles.

C. During process of work, premises shall be kept reasonably free of all debris, cuttings, and waste material resulting from work under this heading. All debris, rubbish, leftover materials, tools and equipment shall be removed from the site prior to final acceptance.

D. Thoroughly clean all parts of apparatus and equipment. Exposed parts which will be painted shall be thoroughly cleaned of cement, plaster and other materials. All grease or oil spots shall be removed with carbon tetrachloride. Such surfaces shall be carefully brushed down with a wire brush to remove rust and other spots and left smooth and clean.

E. Damaged factory applied finishes shall be "touched up". "Touch up" shall be accomplished with preparation, prime and finish coats applied in strict accordance with the manufacturer's recommendations.

3.11 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Complete sets of instructions containing the manufacturer's operating and maintenance instruction for each piece of equipment shall be furnished in accordance with the general requirements to the Engineer. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers; the words "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor and the contract number.

B. The Contractor shall incorporate, among others in the sets of operating and maintenance instructions to the Owner's representative, the following directions:

1. Part numbers of all replaceable parts.
2. Manufacturer's cuts and rating tables.
3. Oiling, lubricating and greasing data.
4. Complete electrical load data from operation tests.
5. Air flow data on all fans indicated on the Drawings.
6. Serial numbers of all principal pieces of equipment.
7. Installing companies' names, addresses and telephone numbers.
8. Control diagrams and operating sequences together with labeling of control wiring and instruments to match diagrams.

C. After approval by the Owner, three (3) copies of this instruction and maintenance manual shall be furnished to the Owner's representative.

3.12 TEMPERATURE CONTROL SYSTEM SEQUENCE

The Contractor shall be responsible for furnishing all the automatic temperature control devices.

A. Submit a shop drawing of the proposed temperature controls, and detailed description of the control sequence.

B. Instruct the electrician, sheet metal worker or other specialist on the particular requirements of

the control devices of which each is responsible.

C. Calibrate all devices and make all final settings and test out the control system under actual operating conditions for satisfactory operation.

D. Wiring: All line voltage conduit and wiring as well as low voltage conduit in connection with the control system shall be provided under the Electrical Section of the specifications.

3.13 INSTRUCTION TO PERSONNEL

A. Upon completion of the installation of the equipment, place a competent person in charge to operate the different systems and instruct the Owner's representative in all details of operation and maintenance. Any required instructions from manufacturer's representative shall be given during this period.

B. The Contractor shall incorporate, among others in the set of operating and maintenance instructions to the Owner, the following directions:

1. Clean and replace fan belts every two months for the first six months.
2. Oil motor bearings every two months (give manufacturer’s recommendations and type of oil) unless permanent lubricant bearings.
3. Check and replace filters as required for proper performance. Replace air filters at completion of construction and provide two (2) extra sets to owner.
4. Oiling, lubricating and greasing data.
5. Belt sizes, type and lengths.
6. Serial numbers of all principal pieces of equipment.
7. Installing company’s names, address and telephone numbers.
8. Control diagrams.

C. After approval by the Architect, two (2) copies of this instruction and maintenance manual shall be furnished to the Owner’s representative.

3.14 GUARANTEE

A. In addition to other guarantees required and as a condition precedent to the issuing of the final certificate for completion payment, the Contractor shall deliver to the Architect a written guarantee that all materials, apparatus and equipment furnished and installed hereunder shall be new and free from all defects. Should any trouble develop within one (1) year from date of acceptance of the building, due to faulty or inferior material and/or workmanship, the trouble shall be corrected by the Contractor without expense to the Owner. The Contractor shall guarantee all apparatus and equipment to deliver the capacities as scheduled and/or specified.

3.15 DESCRIPTIVE NAMES

A. Selected Manufacturers: Where the name of a selected manufacturer of equipment, fixtures, or material is specified, the proposal of the Contractor shall be based on the use of the named product or equivalent product of manufacturers if such are listed. No substitutions will be

permitted.

END OF SECTION

SECTION 23 05 00 - MECHANICAL COMMON WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section provides the basic mechanical requirements that apply to the Work of Division 23.

B. Related Requirements:

1. Division 01: General Requirements.
2. Division 26: Electrical.

1.02 REGULATORY REQUIREMENTS

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. AMCA - Air Movement and Control Association.
2. ANSI - American National Standards Institute.
3. ASME - American Society of Mechanical Engineers.
   a. ASME Boiler and Pressure Vessel Code.
   b. ASME B31 - Code for Pressure Piping.
4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute.
5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
6. ASTM - American Society for Testing and Materials.
   a. ASTM A53 - Specification for Welded and Seamless Pipe.
7. CSA - Canadian Standards Association.
8. FM Global - Factory Mutual Global
9. IAPMO - International Association of Plumbing and Mechanical Officials.
10. NFPA - National Fire Protection Association.
11. OSHA - Occupational Safety and Health Administration.
12. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
13. UL - Underwriters Laboratories Inc.
14. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:

1. CBC, California Building Code, and CMC, California Mechanical Code.

a. Latest edition as adopted by the City of Compton, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.

2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.

3. OSHA - Occupational Safety and Health Administration.

4. CDPH – California Department of Public Health.

5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00: Submittal Procedures and with specific requirements of Division 23 sections, as applicable.

B. After Architect's approval, the above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 31 13: Project Coordination and Section 01 3300 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 31 13 and Section 01 3300 and shall indicate at a minimum:

1. Complete system layout of equipment, components, ductwork, and piping, indicating service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger / support locations. All the above items shall be coordinated on the shop drawings according to the requirements of Section 01 31 13.

2. Schedule and description of equipment, ductwork, piping, fittings, valves, dampers, and controllers.

1.04 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of mechanical and control system drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and three sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return manuals. Manuals shall be bound in accordance to Section 01 77 00. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

1) Identification of components and controls.

2) Pre-start checklist and start-up procedures.

3) Normal operation settings and checklists.

4) Pre-shut down checklist and shut down procedures.

5) Trouble shooting checklist and guidelines.

6) Recommendations for optimum performance.

7) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 23 that includes the following as a minimum:

1) Manufacturer’s model, identification and serial numbers.

2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

3) Directory of manufacturer’s representatives, service contractors and part distributors.

4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of mechanical and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 01 45 25.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Los Angeles County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.05 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 23. Contractor shall coordinate work in accordance with Section 01 31 13 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.07 PRELIMINARY OPERATION

A. OAR may require any portion of mechanical Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the Project Inspector at least 24 hours in advance of lighting or re-lighting pilots.

1.08 TRAINING OF OWNER PERSONNEL

A. Training of Owner’s personnel shall include:

1. A minimum of 8 hours of on-site overview of the overall Mechanical System.

2. Refer to Division 23 sections for specific training on each of the components of the Mechanical System.

3. A minimum of 8 hours of on-site overview identifying location and function of all Control Valves and Actuator assemblies.

4. A minimum of 40 hours of (in classroom) software training for a minimum of 20 Compton College personnel on EMS/BMS if such systems are utilized in the project. Training shall be conducted at control contractor training facility with computer setup for each person attending.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.09 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. HVAC equipment products from different manufacturers are never identical. Equipment approved as being equal is interpreted as being equivalent in capacity, performance and quality. The dimensions, weight, configuration and utility requirements could be quite different from the equipment used as the basis of design. Due to these differences, additional coordination and adjustments by the Contractor are required. For the equipment to be deemed truly equal, the additional coordination and adjustments by the Contractor should not incur any additional cost to the Owner and any additional labor to the design team.

D. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. All the additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

E. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.01 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.02 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes or ducts pass through, or are located within one inch of any construction element, install a resilient pad, 1/2 inch thick minimum, to prevent contact.

C. Furnish all necessary provisions for recesses, chases, and accesses and provide blocking and backing as necessary for proper reception and installation of mechanical Work.

3.03 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment as indicated on Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.04 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 23, including this Section.

B. Tests required by other sections of the Contract Documents include the following:

1. Test and balance of mechanical equipment and systems: Refer to Section 01 45 25: Testing, Adjusting, and Balancing for HVAC.

2. Hydrostatic test of boilers: Refer to Section 01 45 25: Testing, Adjusting, and Balancing.

3. Test of smoke and fire detectors: Refer to Division 26: Electrical.

C. Additional tests may be required in the case of products, materials, and equipment if:

1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

D. Piping Tests:

1. Perform tests required to demonstrate that operation of mechanical systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be

performed in presence of the Project Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.

2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.

3. Pressure gages furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.

4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.

6. Refrigerant piping may be tested with a halide detector or calibrated electronic testing equipment.

7. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Project Inspector.

8. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

E. Pipe Testing Schedule:

System Tested	**Test Pressure (psig)**	**Test With:**
Hot water heating system piping and chilled water piping	150	Water
Refrigeration piping		
R-22	400	Dry nitrogen
R-134a	300	Dry nitrogen
R-401a	300	Dry nitrogen
R-401b	300	Dry nitrogen
R-404a	500	Dry nitrogen
R-407c	500	Dry nitrogen
R-410a	600	Dry nitrogen
R-507	500	Dry nitrogen
Radiant panel piping	150	Water

F. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants

have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.

2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.

3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of heating, ventilating, and air conditioning equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified heating and cooling capacities. If equipment passes, install new filters. If equipment fails, it shall be adjusted and retested until system meets all applicable codes.

4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

   a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.

6. Provide electric energy and fuel required for tests.

7. Final adjustment to equipment or systems shall meet specified performance requirements.

8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

G. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, mechanical equipment and systems shall be operated and tested as indicated in Paragraph 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Immediately before starting tests, air filter media shall be cleaned or renewed. Roll-type filters shall be advanced to provide new clean media. Cleanable type media shall be thoroughly cleaned and re-oiled with new, clean oil as recommended by manufacturer if they are of viscous impingement type. Disposable type filters shall be replaced with new filters. Replaceable media shall be replaced with new media.

4. An accurate means of measuring air flow and temperatures shall be furnished to balance air supply, return, and exhaust systems so uniform temperatures occur in every room and design airflow is obtained through registers, diffusers, and grilles.

5. Systems shall be adjusted to provide airflows indicated including maximum fresh air and maximum return air. Dampers shall be checked for proper settings and operation. Air and water inlet and leaving temperatures at coils shall be checked. Complete

operational data including airflows, room temperatures, fan speeds, motor currents, plenum, and duct static pressures shall be tabulated.

6. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 23 0513: Basic HVAC Materials and Methods.

3.05 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by mechanical systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.06 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 50 00: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pipe coils, pumps, compressors and similar equipment.

5. Interior of ductwork shall be maintained free of dirt, grit, dust, loose insulation, and other foreign materials.

6. Air handling equipment shall not be operated until building is cleaned and air filters are installed.

7. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

8. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas. Refrigerant piping shall be cleaned as specified.

END OF SECTION

SECTION 23 05 13- MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 23.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 07: Thermal and Moisture Protection: Polyvinyl-Chloride Roofing.

3. Division 23: Heating, Ventilating, and Air-Conditioning.

4. Division 26: Electrical.

5. Section 31 23 23: Excavation and Fill for Utilities.

1.02 SUBMITTALS

A. Provide in accordance with Division 01, Section 23 05 00 and specific requirements of each section of Division 23.

1.03 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, CISPI, NFPA, FM Global, UL, CPC (California Plumbing Code), CMC (California Mechanical Code), CSA.

B. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the Architect.

1.04 COORDINATION

A. Coordinate related Work in accordance with provisions of Section 01 31 13: Project Coordination.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in Section 23 05 00, manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.02 MANUFACTURERS AND MATERIALS

A. Air and Dirt Separators:

AS-1 Furnish Spirotherm, Bell and Gossett, or Wessels air and dirt separation fitting on the hot water heating system, chilled water system, and closed loop fluid cooler system. Fittings shall be fabricated steel, rated for 150 psig design pressure and selected for less than one foot of water pressure drop and entering velocity not to exceed 4 feet per second at specified GPM. Performance curves from the unit manufacturer shall be furnished as part of the submittal for each unit. Units shall be furnished with internal copper coalescing medium to facilitate maximum air and dirt separation and suppress turbulence. Units shall be furnished with galvanized steel strainer and stainless steel collector tube. Provide integral high capacity float actuated air vent at top fitting of tank. Furnish cast iron float actuated air vent rated at 150 psig, threaded to the top of the fitting. Unit shall be furnished with the bottom of the vessel extended for dirt separation with the system connection nozzles equidistant from the top and bottom of the vessel and shall include a blowdown connection and valve.

Bell and Gossett, Spirotherm, Wessels, or equal.

B. Balancing Valves:

BBV-1 Dual purpose, balancing and shut-off:

1. Direct operated Pressure Regulator: Class 200# SAG duct iron body, silicone chrome spring, stainless steel 316L Bellows/push rod.

2. Pilot operated Pressure Regulator Class 250# SAG cast iron body, cast iron cover, stainless steel valve stem, valve seat.

Sarco Type BRV 2, 71, 25P Armstrong GD 45 GP 28
Hoffman series 754

C. Boiler Blow-Off Valve:

BOV-1 Boiler blow-off (drain): Refer to Section 23 50 00.

D. Ball Valves: Bronze, 2 inches and smaller:

BV-1 Class 150, 600 psi, CWP, 2 piece construction reinforced Teflon seats, full port, adjustable packing gland, stainless ball and stem, threaded ends.

Hammond UP-8303A/UP-8305/UP-8513, NIBCO T-685-80-LF/TS-685-66-LF, Milwaukee UPBA400S/450S.

BV-2 Class 150, 600 psi CWP, 2-piece construction, bronze body, reinforced Teflon seats, adjustable packing gland, (no threaded stem designs allowed), threaded ends.

Hammond UP8301A, NIBCO T-585-70, Milwaukee BA-400.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-Seal Handle.

E. Butterfly Valves:

BFV-1 Centerline Series A, 200 psi CWP tight shut-off.

1. Body: Lug type ductile iron. Suitable for bi-directional dead-end service at rated pressure without use of downstream flange.

2. Disc: Bronze, or aluminum bronze.

3. Stem: One or two-piece, 400 series stainless steel.

4. Seat and O-Rings: EPDM.

5. Upper and Lower Stem Bearings: Copper alloy or non-metallic material.

6. Operators: Valves 6 inches and smaller, with lever handle. Valves 8-inch and larger, with manual gear operator and disc position indicator.

7. Manufacturers:

   a) Valves 2.5 to 6-inch: NIBCO, Milwaukee ML-233E, Hammond 6411-03.

   b) Valves 8-inch and larger: Milwaukee ML 333E, Hammond 6411-03, NIBCO LD 2000.

8. Grooved ends: Valves 6 inches and smaller, Victaulic No. 700 or NIBCO No. GD-4765-3 with lever handles. Valves 8 inches and larger, Victaulic VIC-300 Masterseal Series 761, NIBCO No. GD-4765-5, Gruvlok Fig. 7700 Series, with manual gear operator and disc position indicator.

F. Check Valves:

1. Bronze, 2-inch and smaller:

   CHV-1 Class 125, 200 CWP swing check, Teflon disc, threaded ends.

   NIBCO T-413-Y, Milwaukee 509-T, Hammond IB-940.

   CHV-2 Class 150, 300 psi, CWP, swing check, bronze, Teflon disc, threaded ends:

   Stockham B-321; Crane 11TF, NIBCO T-433, Milwaukee 510-T, Hammond IB-946..

2. Cast Iron 2-1/2 and larger:

CHV-3 Class 125, 200 psi, CWP, IBBM, renewable seat and disc, bolted cap, threaded ends:

Crane 372, Stockham G-927, NIBCO T-918-B.

CHV-4 Class 125, 200 psi, CWP, IBBM, renewable seat, bronze or cast iron disc, bolted cap, flanged ends:

Stockham G-931, Crane 373, NIBCO F-918 B, Milwaukee F-2974-M, Hammond IR-1124-HI.

CHV-5 On pump discharge, Class 250, 400 psi, CWP, wafer check, center guided disc, spring actuated:

NIBCO W-960B, Keckley Co. Style CW, Val-Matic 1400

G. Expansion Tank:

ET-1 Pressurized, vertical, steel expansion tank for non-potable water systems with a replaceable, heavy duty, Butyl rubber bladder, 1 inch or 1 ½-inch NPT system connection, 3/4 inch drain, 0.302 inch-32 standard automobile tire valve type charging connection, lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped for 125 psi working pressure. The tank must be also rated for a continuous working temperature of 240 degrees F. Provide weather and rust resistant coating.

Bell and Gossett, Wheatley, Taco, Amtrol.

H. Flow Control Valve – Manual:

FC-1 Flow control valves: Bell and Gossett Series CB circuit setter balancing valve, line size, with integral pointer (to register degree of valve opening), differential pressure meter connections with built-in check valves and lockable memory stops. Armstrong Series CBV circuit-balancing valves, Victaulic/TA Hydronics.

I. Venturi Flow Measuring Device:

FMD-1 Preso B-plus Series, Victaulic “Style 733”, Griswold QuickSet Metering Stations, venturi type flow measuring device. Provide on the main heating hot water and chilled water lines and other locations as required for balancing, as indicated, between straight sections of pipe. Upstream pipe section shall be not less than 5 diameters in length and downstream section shall be not less than 2 diameters in length. Venturis shall be furnished complete with quick disconnect valves, safety shut-off with memory valves and attached metal identification tag.

1. 2-inch or smaller shall be furnished with threaded connections.

2. 2 ½-inch or larger shall be furnished with flanged or grooved connections.

J. Electronic Flow Readout Meter:

FM-1 Flow meter shall combine the functions and ranges of several gages into a single board range meter. Meter shall function as a compound pressure gage measuring the high side and low side pressure simultaneously and display each reading in sequence. Meter shall be furnished complete with a shut-off, bypass, and blow down valve network installed on a portable meter panel. A carrying case shall be provided with storage for accessories. Meter shall automatically select the proper range, compensate for temperature, and reset itself. Memory function shall store up to 90 sets of pressure and temperature. Pressure reading shall be accurate to plus or minus 2 percent of reading from 0.01 to 150 psi. Temperature readings shall be accurate to plus or minus 0.5 degrees F and plus or minus 1.0 degree F. from minus 65 degrees F to 250 degrees F. The flow metering device shall be Hydrodata Multimeter HDM-250 as manufactured by Shortridge Instruments Inc., and shall be furnished with pressure gage, portable meter panel and with valve network, carrying case, battery charger, instruction manual and certificate of calibration, two 6 feet long by 1/2 inch OD pressure hoses with quick disconnects, two 8 foot by 1/4 inch OD drain hoses, and a set of adapters.

K. Gate Valves:

1. Bronze, 2 inches and smaller:

GV-1 Class 125, 200 psi CWP, bronze body and bonnet non-rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

Hammond IB645, Crane 1701, Milwaukee 105, American 3F, NIBCO T-113.

GV-2 Same as GV-1, except solder ends:

NIBCO S 113, Milwaukee 115, Hammond IB 647.

GV-3 Class 125, 200 psi WOG, rising stem, inside screw, screw-in bonnet, solid disc, threaded ends:

Stockham B-100, Crane 428, NIBCO T-111, Milwaukee 148, Hammond IB-640.

GV-4 Same as GV-3 except solder ends:

NIBCO S-111, Milwaukee 149, Hammond IB-635, or equal.

GV-5 Class 125, 200 psi CWP, rising stem, union bonnet, solid disc, threaded ends:

Stockham B-105, Crane 428 UB, NIBCO T-124, Milwaukee 1152, Hammond IB-617.

GV-6 Class 150, 300 psi CWP, rising steam, union bonnet, solid wedge, threaded ends:

Crane 431 UB, Stockham B-120, NIBCO T-134, Milwaukee 1151, Hammond IB-629.

2. Iron Body Gate Valves; 2 1/2 inches and larger:

GV-7 Class 125, O S and Y, IBBM, bolted bonnet, solid disc, flanged ends:

Hammond IR1140HI, Stockham G623, Crane 465-1/2, NIBCO F-617-0, Milwaukee F 2885M.

L. Heater Vent Pipe:

1. Schedule Number:

HVP-1 Shall be UL approved for service specified. Concealed heater vent pipe, including pipe in or through attic spaces, shall be City of Compton approved double wall metal vent pipe. For recessed wall heaters, furnish B.W. type. All others may be Type B, or B.W. Clearances must comply with Compton code and conditions of UL listing.

American Metal Products Co., Inc., Simpson Dura-Vent, AmeriVent, Hart & Cooley Mfg. Co., Metalbestos.

M. Liquid Level Gage:

LLG-1 Refrigerant type, carbon steel with stainless steel trim or all forged steel construction, back-seating standard design. Upper and lower valve furnished with ball check valves; 1/2 inch diameter glass on center. Four 3/16 inch diameter gage glass guard rods or slotted steel guard.

Peneberthy, Henry, Conbraco.

N. Piping:

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 23 0553: HVAC Identification.

3. Refer to HVAC Piping: Section 23 2013 for heating and chilled water piping and fittings.

O. Pipe Isolators:

PLA-1 Absorption pad shall be not less than 1/2 inch thick, unloaded. Pad shall completely encompass pipe.

Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator.

PLA-2 Plastic cushion to form an insulating liner and eliminate metal to metal contact when securing copper tubes and pipes in air conditioning and refrigeration insulation preventing galvanic erosion. (Acoustical Type for Sound Absorption)

Hydra-Zorb Cushion Clamps, LSP Products Group Acousto Clamp.

P. Pressure Gage: Aluminum or steel case, minimum 4-1/4 inches dial; pressure type or combination vacuum-pressure type, with provisions for field calibration. Dial indicator to indicate pressure in psi with accuracy to within plus or minus 0.5 percent of maximum dial reading. Furnish gages with restriction screw, size 60, to eliminate vibration impulses. Black case and ring, bourdon tube of seamless copper alloy with brass tip and socket. Three way gage cock, constructed of brass with stuffing box, 1/2 inch couplings, with fixed or movable cap nut to shut off pressure gage.

PG-1 Pressure type, black drawn steel case, 4 ½-inch glass dial, range approximately twice line pressure.

Marsh Keckley, Trerice, Weksler, Weiss.

Q. Safety Relief Valves:

SRV-1 Combination temperature and pressure relief type. CSA approved. Set to open at 125 psi pressure.

Watts 40L, Cash-Acme NCLX-1, Wilkins TP220.

SRV-2 Same as SRV-1, except provide on storage type water heater with anode in dip tube.

Watts 10 x L, CashAcme NCLX-1, Wilkins TP220.

R. Strainers:

STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blowout piping, same size as blowout plug.

1. 2-inch and smaller:
   C.M. Bailey No.100-A, 250 lb., cast iron body, threaded, Keckley 'B', Spirax Sarco Y-type.
2. 2 ½-inch and larger:
   C.M. Bailey No.100-A, 125 lb., cast iron body, flanged, or Victaulic style 732, 300 psi, ductile iron body, grooved, fusion bonded epoxy coated.
   C.M.Bailey, Armstrong, Muessco, Keckley 'A'.

STR-2 Y pattern cast iron bodies, 125 psi, monel screen. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2 inches, flanged ends fusion bonded epoxy coated for 2 1/2 inches and larger perforations, in accordance with the following:

1. Other services - 16 square mesh.

Bailey No.100, Armstrong, RP&C, Keckley.

S. Temperature Control Valves:

TCV-1 Motor-operated valve, Forged brass bodies rated at no less than 400 psi working pressure; Chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.

Operated by Electronic Valve Actuator, manufactured, brand labeled or distributed by Belimo, TA, Honeywell.

TCV-2 Valves, automatic, electric, 3-way control.

Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, NPT female end fittings, with dual EPDM O-ring packing design, fiberglass reinforced Teflon flow characterizing disc. [NPS ¾ inch and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, NPT female fiberglass reinforced Teflon flow charactering disc.]

Belimo, Flow Control Industries, Inc., Delta Control Products

T. Thermometers

1. Industrial:

T-1 Straight type with fixed or ratable stem, extruded or cast brass or cast aluminum case and brass separable well 6 inches minimum scale, angle or straight type range 30 degrees - 240 degrees F.

Weksler, Trerice, Weiss, Ashcroft, Marshalltown.

T-2 Round type 3 ½-inch minimum dial range of 100 between 30 degrees and 155 degrees F, color coded red above 150 degrees F. Brass chrome plated case.
Ashcroft, U.S. Gage, Marsh, Weiss.

2. Remote:

T-3 Liquid-filled capillary type with bulbs as required for remote and insertion mounting dials of 3 ½-inch minimum diameter, non-ferrous internal parts, external means for re-calibration, glass or plastic lens and steel or non-ferrous case suitable for wall, duct or panel mounting range 30 degrees to 240 degrees F.

U. Valves (Air Vent):

VAV-1 Hot or chilled water air release valves shall be cast brass rated for 150 psig design pressure and 270 F operating temperature.

Spirotherm, Bell & Gossett, Taco.

VAV-2 Hot or chilled water space heating system air valve, brass with nickel trim 1/4 inch connection, disc type for manual or automatic venting.

Hoffman 500, Spirotherm, Watts.

VAV-3 Brass petcock, 1/4 inch connection by 1/4 inch copper tube to high point of coil or line by means of a tapped cap on top of 6 inches vertical nipple. Petcock to be installed approximately 5 feet 6 inches above finish floor.

Amtrol, Watts, Dole.

V. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):
   a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.
   b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.
   c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.
   d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the Architect.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the Architect, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the Architect.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 05 00.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Hot and chilled water circulating piping installed for space heating or cooling shall pitch up to a high point at a slope of 1/4 inch in 10 feet in the direction of flow. Where supply and return lines are exposed, both lines shall pitch in same direction. Otherwise, where possible, lines shall pitch up toward compression tank.

14. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide and install pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide and install adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

2. Sleeves shall provide 1/2 inch clearance around pipes, except plastic pipe shall have 1-inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between 2 or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, or equal, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the Architect.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an Owner-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the Project Inspector with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

REFERENCE: ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-29 TESTS OF WELDERS AND WELDING OPERATORS.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an Owner recognized, DSA approved testing laboratory.

REFERENCE: ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-51 RADIOGRAPHIC EXAMINATION OF WELDED JOINTS.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

a. Cracks of any type.

b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

c. Elongated slab inclusions longer than 1/4 inch.

d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

e. Undercuts greater than 1/32 inch.

f. Overlaps, abrupt ridges or valleys.

2. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

3. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

4. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

REFERENCE, ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, UW-52.

5. Owner shall cause to be performed additional random UT and radiographic examinations of welds. Owner shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

6. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods for review by the Architect.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of two pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the Owner in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM A53, Type B, steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

   NOTE: Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

   a. Refrigerant and Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.

   b. All other services Furnish sealant, suitable and as reviewed by the Architect.

3. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B1.20.1 for tapered pipe threads.

4. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

5. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3 Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in

accordance with instructions in the Copper Tube Handbook issued by Copper Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be thoroughly cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

O. Joints shall be Vic-Press 304TM, or equal, made with Victaulic Series ‘PFT’ tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Pressure Independent Characterized Control valve type shall be suitable for service on which installed.

4. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

5. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

6. Valves for similar service shall be of one manufacturer.

7. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American Valve, NIBCO, Hoffman, or equal.

8. Ball valves below grade in yard boxes shall have stainless steel handles.

9. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

   a. A combination temperature and pressure relief valve or combination of valves on each heating hot water boiler. Temperature sending element shall extend into water inside boiler.

10. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

Q. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc., or equal.

R. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or

seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer's Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

3. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of 5, based on ultimate tensile strength of material installed.

4. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by Architect and DSA.

5. Burning holes in beam flanges or other structural members is not permitted without review by the Architect and DSA.

6. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

7. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

   a. Tolco I beam, Fig.62 for maximum 1000 lbs.

   b. Tolco I or WF beam, Fig. 329, for maximum of 1290 lbs.

8. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

   a. Tolco Fig.310 for maximum of 600 lbs.

   b. Tolco Fig. 309 for maximum of 1140 lbs.

9. For fastening to wood ceilings, beams, or joists, furnish Anvil Fig. 128R, Anvil Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3-inch long, with two staggered 10d nails, clinched over joist.

10. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes 1/2 inch through 2-inch, 1/2 inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and 3/4 inch for 8-inch and 10-inch pipe.

11. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.

12. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

13. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

14. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

15. Vertical Piping:

    a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

    b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

    c. Copper tubing sizes 1 ¼-inch and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

    d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

16. Horizontal Piping:

    a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block, or equal. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

        1) At PVC roofing provide walk tread, polyester reinforced, UV resistant, with surface embossment at rooftop supports. Heat welding of walk pads shall only be done by manufacturer certified installers.

            a) Sika-Sarnafil and Carlisle: Walk tread shall be no more than one inch larger than the plan area of the pipe support blocks and adhered to the roof membrane with Sika 1A or Carlisle Universal Single-Ply sealant, as applicable.

            b) Johns Manville: Walk tread shall be installed under the pipe support blocks and adhered to the blocks, if possible, and left

loose laid on top of the PVC roof system. Walk-pad shall have a minimum of 4 inches of material past perimeter on all 4 sides of block.

2) Built-up roofing: Provide APP granulated modified torch-down at each pipe support block. Torch-down shall extend 2 to 4 inches beyond the edges of the block and adhered by torch application over existing cap sheet membrane. This work shall be performed by a certified roofer.

b. Piping Mounted to Underside of Roof and Decks and from Structure:

1. Insulated steam and space heating hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Anvil Figure 212, or equal, steel hangers with welded eye rods to permit hinge movement at point of attachment of hangers. Hinge movement at point of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Anvil Figure 278X, or equal.

2. Chilled water supply and return piping, condenser water piping, insulated refrigerant piping may be supported with Tolco Figure 1, B-Line Figure B3100, Anvil Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.

c. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

17. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

18. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

19. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

S. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct. No soldered joints on roof flashings will be allowed.

3. Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 7 inches.

4. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

5. Cast iron, steel, brass, and copper pipe, which terminate less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

6. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of 3/4 inch.

7. Flashing and flanges on ducts shall be installed waterproof at point of connection to the duct by riveting and soldering. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

8. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

T. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 0548, unless indicated otherwise whether indicated on drawings or not.

END OF SECTION

SECTION 23 05 29- HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

a. This Section includes the following hangers and supports for HVAC system piping and equipment:

1) Steel pipe hangers and supports.

2) Trapeze pipe hangers.

3) Metal framing systems.

4) Thermal-hanger shield inserts.

5) Fastener systems.

6) Pipe stands.

7) Equipment supports.

b. Related Sections include the following:

1) Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

2) Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

3) Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

a. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

b. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

a. Product Data: For the following:

1) Steel pipe hangers and supports.

2) Thermal-hanger shield inserts.

3) Powder-actuated fastener systems.

b. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1) Trapeze pipe hangers. Include Product Data for components.

2) Metal framing systems. Include Product Data for components.

3) Pipe stands. Include Product Data for components.

4) Equipment supports.

c. Welding certificates.

1.6 QUALITY ASSURANCE

a. Welding: Qualify procedures and personnel according to the following:

1) AWS D1.1, "Structural Welding Code--Steel."

2) AWS D1.3, "Structural Welding Code--Sheet Steel."

3) AWS D1.4, "Structural Welding Code--Reinforcing Steel."

4) ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.1 MANUFACTURERS

a. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1) Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE HANGERS AND SUPPORTS

a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

b. Manufacturers:

1) AAA Technology & Specialties Co., Inc.

2) Bergen-Power Pipe Supports.

3) B-Line Systems, Inc.; a division of Cooper Industries.

4) Carpenter & Paterson, Inc.

5) Empire Industries, Inc.

6) ERICO/Michigan Hanger Co.

7) Globe Pipe Hanger Products, Inc.

8) Grinnell Corp.

9) GS Metals Corp.

10) National Pipe Hanger Corporation.

11) PHD Manufacturing, Inc.

12) PHS Industries, Inc.

13) Piping Technology & Products, Inc.

14) Tolco Inc.

c. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

d. Nonmetallic Coatings: Plastic coating, jacket, or liner.

e. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

a. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

a. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

b. Manufacturers:

1) B-Line Systems, Inc.; a division of Cooper Industries.

2) ERICO/Michigan Hanger Co.; ERISTRUT Div.

3) GS Metals Corp.

4) Power-Strut Div.; Tyco International, Ltd.

5) Thomas & Betts Corporation.

6) Tolco Inc.

7) Unistrut Corp.; Tyco International, Ltd.

c. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

d. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

a. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

b. Manufacturers:

1) Carpenter & Paterson, Inc.

2) ERICO/Michigan Hanger Co.

3) PHS Industries, Inc.

4) Pipe Shields, Inc.

5) Rilco Manufacturing Company, Inc.

6) Value Engineered Products, Inc.

c. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

d. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

e. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

f. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1) Manufacturers:

a) Hilti, Inc.

b) ITW Ramset/Red Head.

c) Masterset Fastening Systems, Inc.

d) MKT Fastening, LLC.

e) Powers Fasteners.

b. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1) Manufacturers:

a) B-Line Systems, Inc.; a division of Cooper Industries.

b) Empire Industries, Inc.

c) Hilti, Inc.

d) ITW Ramset/Red Head.

e) MKT Fastening, LLC.

f) Powers Fasteners.

2.7 MISCELLANEOUS MATERIALS

a. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

b. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1) Properties: Nonstaining, noncorrosive, and nongaseous.

2) Design Mix: 5000-psi, 28-day compressive strength

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

a. Specific hanger and support requirements are specified in DSA approved drawings. It shall be per approved drawings.

b. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

2) Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

c. Building Attachments: Shall be per DSA approved drawings:

3.2 EQUIPMENT SUPPORTS

a. Factory fabricated roof curbs.

3.3 METAL FABRICATIONS

a. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

b. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

c. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2) Obtain fusion without undercut or overlap.

3) Remove welding flux immediately.

4) Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

a. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

b. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

3.5 PAINTING

a. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1) Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

b. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

c. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48- MECHANICAL SOUND, VIBRATION AND SEISMIC CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Reduction or elimination of excessive noise or vibration within building due to operation of equipment, machinery, piping, and ductwork as specified.

1. Vibration isolators.
2. Seismic restraint devices.
3. Duct silencers.
4. Acoustic housings.
5. Lining and enclosing ductwork.
6. Acoustic louvers.
7. Sound attenuation boots at supply, return, exhaust and transfer air inlets, outlets and openings.
8. Flexible ducts, conduits and piping.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 01 45 25: Testing, Adjusting, and Balancing for HVAC.
3. Section 23 05 00: Mechanical Common Work.
4. Section 23 05 13: Mechanical Basic Materials and Methods.
5. Section 23 20 13: Mechanical Above Grade Piping.
6. Section 23 30 00: Mechanical Air Distribution.
7. Section 23 80 00: Mechanical Equipment.

1.02 GENERAL REQUIREMENTS

A. Provide vibration isolators to eliminate or reduce the transmission of vibration noise to any part of building and mitigate vibration frequency and load imposed by equipment. Vibration isolators,

base frames, inertia bases and seismic restraints shall be of sufficient size, flexibility and load distribution configuration to assure that deflection, stability and seismic restraint requirements are met without permitting excessive movement when starting. For typical units, no fewer than four isolators shall be provided. Isolators shall be provided to deflect uniformly under operating gravity and equipment thrust loadings to within plus or minus 10 percent of specified deflection values.

B. Static deflections specified are based on the anticipated equipment characteristics. In the event the equipment proposed by the Contractor has characteristics other than those indicated, particularly the rated rpm, the static deflection shall be re-evaluated and the proper mountings and other devices shall be provided.

C. Where fabricated vibration isolator units are indicated, furnish manufacturer's standard catalog products with printed loading ratings or certified submittals

D. Seismic Requirements:

1. Refer to Seismic Restraint Manual: Guidelines for Mechanical Systems, published by SMACNA and approved by DSA, for minimum seismic restraints required on mechanical components design and construction details.

2. Provide seismic restraints for mechanical equipment or components specified. Where equipment is specified with proprietary names, design for seismic restraints is for first proprietary name listed.

3. Provide restraints, bracing and anchorage as required for the mechanical equipment, electrical equipment and components specified in the Contract Documents. Restraints, bracing and anchorage shall be installed to resist the total design earthquake or wind loads in any direction in accordance with CBC and SMACNA guidelines.

4. Provide restraints, bracing, and anchorage for the mechanical equipment and components.

5. For rigidly mounted liquid filled steel pipe, comply with the following:

   a. Provisions of NFPA Pamphlet 13, section for sway bracing.

   b. Provisions of NFPA Pamphlet 13, section for earthquake protection.

   c. Hanger spacing as specified in Section 23 05 13 under Hanger Spacing Schedule.

   d. SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems and approval by DSA.

6. For flexibly mounted liquid filled steel pipe, comply with the following:

   a. Provisions of the California Building Code for flexibly mounted equipment.

b. Provisions of VISCMA (Vibration Isolation and Seismic Control Manufacturer's Association) Seismic Control Device Installation, Best Practices Manuals.

c. Installer may provide a DSA or OSHPD approved system such as the SMACNA Seismic Restraint Manual with Addendum No. 1, the Mason Industries Seismic Restraint Guidelines or other proprietary pre-approved system.

7. For ductwork and other mechanical equipment restraints, comply with SMACNA Seismic Restraint Manual: Guidelines for Seismic Mechanical Systems and obtain approval by DSA.

1.03 SUBMITTALS

A. Provide in accordance with Division 01.

1. Catalog cuts and data sheets on specific vibration isolators, seismic restraints, and anchors demonstrating compliance with the Specifications.

2. Shop Drawings for each piece of equipment including dimensions, structural member size, support point, vibration, and seismic restraints.

3. Written approval of frame design to be furnished by the equipment manufacturer.

4. Drawings indicating methods for suspension, support, seismic restraints, guides, etc., for piping, ductwork, etcetera.

5. Drawings indicating methods for isolation of pipes, ducts etcetera, piercing slabs, beams, etcetera.

B. Vibration Test Reports: At completion of installation, submit the following documents. Submission of these documents must be complete before final acceptance of vibration isolation systems is given. Assistance from the vibration isolation equipment Manufacturer may be required.

1. Complete tabulation showing for each vibration isolator:

a. Actual static deflection measured at the project.

b. Specified minimum static deflection.

2. Report certifying:

a. Each piece of operative rotating mechanical equipment does not exceed the specified vibration displacement level.

b. Each piece of isolated equipment or equipment component (ducts, pipes, conduit, etcetera) is not short-circuited by any means.

c. Requirements of Part 2 are satisfied for equipment.

1.04 QUALITY ASSURANCE

A. Standards and Codes: Comply with applicable codes and standards having jurisdiction including, but not limited to:

1. NFPA, Pamphlet 13.

2. ASHRAE Handbook: HVAC Systems and Equipment.

3. SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems.

4. California Building Code.

5. VISCMA

a. Installing Seismic Restraints for Mechanical Equipment.

b. Installing Seismic Restraints for Duct and Pipe.

B. Qualifications of Manufacturer and Installers: Comply with provisions as set forth in Section 23 0500: Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 GENERAL

A. Furnish and install vibration dampers, sound isolation pads, flexible connections and similar equipment required to prevent sound of water flowing in pipes, vibration of motors, and motor operated equipment from being transmitted to building structure; and, in case of fans, from being transmitted along ducts. Piping shall be isolated from vibrating equipment by furnishing required flexible connectors.

B. Mmotor operated equipment shall be installed on anti-vibration units.

C. Fans, except curb-mounted roof-type exhaust fans and wall mounted propeller fans, shall be installed with anti-vibration units, whether indicated on Drawings or not. Fans built into air handling units may be furnished with independent anti-vibration mountings or whole unit may be installed on an external vibration isolation system.

D. Other equipment shall be installed on anti-vibration bases, pads, or hangers, unless specifically noted otherwise on Drawings. Package units, furnished with built in anti- vibration bases, do not require unit bases unless otherwise specified.

1. Unless specified otherwise, anti-vibration bases shall be M.W. Sausse & Co, or equal, of the Model Number specified or indicated on the drawings. Furnished base including sub-base, shall be manufactured by same company with fan and integral motor base. Seismic restraints may be incorporated into bases or furnished separately.

2. Inertia anti-vibration bases shall conform to requirements indicated.

3. Unless noted otherwise, furnished anti-vibration bases, including supporting units for inertia bases, shall be of the spring type.

4. Selection of bases or supporting units shall be in accordance with manufacturer's recommendations based on following installed minimum effective isolation efficiencies (where not provided with each piece of equipment):

a.	Centrifugal fans, packaged fan and coil units less than 800 RPM	80 percent
b.	Centrifugal fans over 800 RPM	90 percent
c.	Centrifugal pumps	95 percent

E. Flexible duct connections shall be provided at inlet and outlets of each fan or HVAC unit, except curb-mounted roof exhaust fans whether indicated on the drawings or not.

F. Flexible pipe or conduit connections shall be provided at piping and conduit connections to HVAC units, pumps, and other moving (reciprocating or rotating) mechanical or electrical equipment provided under this Section whether indicated on the drawings or not.

G. Flexible connections for Freon piping shall be seamless flexible metal hoses of type and length recommended by manufacturer and suitable for system operating pressure.

H. Flexible connections for all other piping shall be flexible metal hose or spool type with flanged ends, unless otherwise specified. Metal hose shall be covered with protective braiding in areas where physical abrasion may occur, or for personnel safety.

I. Spool types shall be similar to American Rubber Co., Mercer Rubber Co., PROCO Products, Inc., or equal, and hose types shall be similar to DME, Inc., U.S. Flex, Pennflex, Anaconda Flexpipe, Keflex, or equal with any required modifications to meet specified requirements. Flanges shall be furnished with steel retaining rings. Units installed on discharge side of pumps shall be furnished for a suitable working pressure of not less than 100 psig, and those on suction side for working pressures of 50 psig or 30 inches Hg vacuum.

J. Units installed in cold water lines (less than 125 degrees F) shall furnish a minimum temperature rating of 180 degrees F and those installed in hot water lines (above 125 degrees F) shall be constructed of special heat resistant materials and be furnished for a minimum temperature rating of 220 degrees F, continuous operation. Units shall be able to withstand a maximum lateral deflection of 3/8 inch. Temperature and pressure ratings shall be molded into body of each spool unit so they are easily identified. Spool types shall be for straight in flow only.

K. Spool type units shall be furnished with control units comprised of a minimum of two tie-rods and anchor plates or internal guide sleeves to prevent excessive elongation or misalignment. Rubber washers shall be provided under bolt heads and rubber grommets in bolt holes to prevent any metal to metal contact between bolts and flanges.

L. Where hose type units are furnished, restraining anchors or braces shall be provided if excessive or undesirable pipe movement occurs when system is operated.

2.02 GENERAL PROPERTIES OF VIBRATION ISOLATORS.

A. Shall be provided with markings so that, after adjustment, when carrying their load, deflection under load can be verified; thus determining that load is within proper range of device and that correct degree of vibration isolation is being provided according to the design.

B. Isolators to operate in direct proportion to their load versus deflection curve. Load versus deflection curves shall be furnished by manufacturer and must be linear over a deflection range of 50 percent above design deflection.

C. Wave motion through isolator shall be reduced to following extent: Isolation above resonant frequency shall follow theoretical prediction based upon an un-dampened single degree of freedom system with a minimum isolation of 50 decibels above 150 cycles per second.

D. Vibration isolator spring diameters shall be no less than their deflected height. Furnish spring with a 50 percent overload safety factor.

E. Unless otherwise indicated, equipment installed on vibration bases shall provide a minimum operating clearance of one inch between structural steel base and floor or support base. Provide flexible connectors in piping and flexible conduit in power wiring to minimize transmission of vibration.

F. Isolators and springs exposed to weather shall be hot-dipped galvanized or powder coated after fabrication and before installation. Hot-dipped zinc coating shall be not less than two ounces per square foot by weight complying with ASTM A123. In addition, provide limit stops to resist wind velocity.

G. Where indicated, provide structural steel bases with height saving brackets, and minimum of three points of support. Isolators shall be furnished with a method for leveling.

H. Design isolators and seismic restraints for positive anchorage against uplift and overturning.

I. Provide and install, under this Section of the Specifications, structural steel required to properly support equipment and steel required to support horizontal thrust arrestors.

2.03 ISOLATOR TYPES

A. Type A: Steel Spring Isolators: Un-housed steel spring isolators, laterally stable and unrestrained. Design springs so that ratio of horizontal to vertical spring (stiffness) constant is between 0.9 and 1.3. Natural frequency of isolator must be 1/3 to 1/4 of driving frequency that is to be controlled. Isolators to provide a minimum additional travel to solid equal to 50 percent of rated deflection. Isolators shall be furnished with built-in leveling bolts complete with sound isolation pads type B. Static deflection as specified.

B. Type B: Sound Isolation Pad: Provide under each spring isolator a sound isolation pad, utilizing high quality durable neoprene pad material, loaded to 40 psi. Build sound pad up to 2 layers of

1/4 inch thick neoprene material; separate layers with a 16 gage galvanized sheet metal plate. Top layer shall provide a hardness of 40 durometers and the bottom layer shall be 40 durometers. Cold bond sound pads together and to isolator baseplate.

C. Type C: Neoprene-in-Shear Isolators: Isolator shall be neoprene-in-shear type as recommended by manufacturer. Isolator shall provide a static deflection under rated load at 1/4 inch.

2.04 EQUIPMENT FRAMES

A. Provide mounting frames and brackets to carry load of equipment without causing mechanical distortion or stress to the equipment.

B. Type A Frame: Wide flange members, rigidized structural steel frame with brackets. Maximum allowable deflection at any point on load frame relative to unloaded frame shall be 0.005 inch. Members to be constructed of wide flange beams, with a depth of not less than 1/10 of length of span between isolators. Frame shall be M.W. Sausse & Co. type RMSB-W, as basis of design, or Mason Industries, Caldyn, or equal.

C. Type B Frame: Channel members, rigidized structural steel frame with brackets. Frame to be constructed of channel steel with section depth equal to 1/10th length of longest structural member. Frame shall be M.W. Sausse & Co. type RMSB-C, as basis of design, or Mason Industries, Caldyn, or equal.

D. Type C Frame: Steel gusset or bracket welded or bolted directly to machine frame in order to accommodate isolator. Frame shall be M.W. Sausse & Co. type RMSG, as basis of design, or Mason Industries, Caldyn, or equal.

E. Type D Frame: Fabricated of rectangular channel steel forms for floating foundations to be filled with concrete on the Project site. Channel depth to be a minimum of 1/12th of longest dimension, but in no case less than 6 inches. Form shall include 1/2 inch reinforcing bars installed each way in a layer 1 ½ inches above bottom and drilled steel members with sleeves mounted below holes to receive equipment anchor bolts. Weight of concrete and frame shall be two times or more than the weight of the unit it supports. Frame shall be M.W. Sausse & Co. type RMSBI, as basis of design, or Mason Industries, Caldyn, or equal.

2.05 MANUFACTURERS

A. Acceptable Isolation Manufacturer:

M. W. Sausse' & Co., Inc. (Vibrex)
28744 Witherspoon Parkway
Valencia, CA 91355
(661) 257-3311

1. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.

2. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems.

3. Seismic restraints for equipment shall be designed to meet the criteria established in the California Code of Regulations 2019 edition.

B. M.W. Sausse & Co., Inc. as the manufacturer of Vibration Isolation and Seismic Control Equipment shall have the following responsibilities:

1. Determine adequate vibration isolation and seismic restraint sizes and locations.

2. Provide equipment isolation systems and seismic restraints as scheduled and/or specified.

3. Provide installation instructions and drawings to assure proper installation and performance.

2.06 MATERIALS AND CONSTRUCTION

A. Duct Silencers: Provide factory fabricated duct silencers of tubular or rectangular type, for low or medium velocity service, with arrangements, sizes, and capacities as indicated on the Drawings.

1. Construction:

a. Fabricate silencers of galvanized steel with casing seams sealed or welded to be airtight at a pressure differential of 8 inches water gage between inside and outside of unit, and stiffen or brace as necessary to prevent structural failure or deformation at same condition, or audible vibration during normal operation. Outer casings of rectangular silencer modules shall be made of 22 gage galvanized steel in accordance with ASHRAE Guide of recommended construction for high-pressure rectangular ductwork. Seams shall be lock formed and mastic filled. Outer casings of tubular silencers shall be made of galvanized steel in 18 to 22 gage. Internal acoustic elements of rectangular silencers shall incorporate integral die formed entry and exit to minimize pressure drop and self-noise. Interior partitions for rectangular silencers shall be fabricated of not less than 26 gage galvanized perforated steel. Interior construction of tubular silencers shall be compatible with the outside casings.

b. Filler material shall comply with the following:

1) Fire Safety Standards: NFPA 90A and NFPA 90B.

2) Temperature: ASTM C411.

3) Air velocity: ASTM C1071, UL 181.

4) Fire Hazard Classification: ASTM E84, UL 723-Class 1, NFPA 255.

5) Corrosion Resistance: ASTM C739, C665.

6) Fungi Resistance: ASTM G21.

7) Water Vapor Sorption: ASTM C1104, less than 1 percent by weight.

8) Formaldehyde, Phenolic Resins or other Volatile Organic Compounds: 0 percent.

c. Airtight construction shall be provided by furnishing a duct sealing compound installed on the Project site. Silencers shall not fail structurally when subjected to a differential air pressure of 8 inches w.g. inside to outside of casing.

2. Acoustic Performance: Silencer ratings shall be determined in a duct-to-reverberant room test facility, which provides for airflow in both directions through the test silencer in accordance with ASTM Standard E477. The test facility shall be accredited by the National Voluntary Laboratory Accredited Program for the ASTM E477 test standard. Data from a non-accredited laboratory is not permitted. The test set-up and procedure shall eliminate effects due to end reflection, directivity, flanking transmission, standing waves, and test chamber sound absorption. Acoustic ratings shall include dynamic insertion loss (DIL) and self-noise (SN) power levels both for forward flow (air and noise in same direction) and reverse flow (air and noise in opposite directions). Data shall be for test silencers no smaller than the following cross-sections:

Rectangular, inches - 24 by 24, 24 by 30, or 24 by 36
Tubular, inches - 12, 24, 36, and 48

a. Noise reduction values (dynamic insertion loss) in decibels reference 10-12 watts, shall not be less than (of the model, size and length) indicated on Drawings.

b. Self generated noise in decibels reference 10 to 12 watts, shall not be more than of the model, size and length indicated on Drawings.

3. Aerodynamic performance: Airflow measurements shall be performed in accordance with ASTM specification E477 and applicable portions of ASME, Air Movement and Control Association (AMCA), and Air Diffusion Council (ADC) airflow test codes. Tests shall be reported on the identical units for which acoustic data is presented. Air pressure drops shall not exceed those (of the model, size and length) indicated on Drawings.

4. Certification: With submittals, provide certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance for reverse and forward flow test conditions. Test data shall be for a standard product. Rating tests shall be conducted in the same facility, shall utilize the same silencer, and shall be open to inspection if required by the Architect.

5. Rectangular silencers shall be Industrial Acoustics Company of the model number indicated on the drawing, as basis of design, or Vibro-Acoustics, Dynasonics, SEMCO Silentair, TranSonics, Inc., or equal.

B. Duct Liner: As indicated in Section 23 07 00: Mechanical Insulation.

C. Flexible Ducts: As indicated in Section 23 07 00: Mechanical Insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide isolators, flexible pipe connectors, flexible electrical conduit and flexible duct connectors at all moving mechanical system components to prevent transmission of vibration noise to any part of building whether indicated on the drawings or not.

B. Install isolators to suit imposed load and the vibration frequency to be absorbed. Isolator units shall furnish adequate strength and flexibility to exhibit proper resiliency under machine load and impact without permitting excessive movement when starting.

C. Where commercial vibration isolator and seismic restraint units are specified, furnish manufacturer's standard catalog products with printed loading ratings, or provide substantiating calculations.

D. Install vibration isolators and seismic restraints in accordance with manufacturer's printed installation instructions.

E. Where equipment is belt driven and motor is not installed on equipment, install motor and driven equipment on unitized support, and install entire support isolators. Unitized support to be provided with adjustable slide rails sized for motor weight and frequency. Support shall be Mason Industries type WF, M.W. Sausse & Co., type RMSF, Caldyn, or equal.

F. Do not install any equipment, piping, conduit, ductwork, etc., that makes rigid contact with building or its structural members, unless reviewed by the Architect.

1. Coordinate Work with other trades to avoid rigid contact with building.

2. Correct, before installation, any conflict with other Work that would result in solid contact to equipment or piping due to inadequate space.

3. Obtain inspection from the Project Inspector for concealed Work before enclosure.

4. Notify manufacturer before installation of vibration isolation devices so that manufacturer may instruct and demonstrate technique for proper installation.

G. The furnishing or installation of vibration isolators must not cause any change of position or alignment of equipment, ductwork, or piping, resulting in stresses in piping or ductwork, connections, or misalignment of shafts or bearings. Equipment, piping, and ductwork shall be maintained in a rigid position during installation. Load shall not be transferred to isolator until installation is complete and under full operational load.

H. Pumps, Boilers with Integral Combustion Fans and Miscellaneous Equipment, mounted on roof or raised floors: Install each unit with its motor on a vibration isolated base utilizing type B frames, except where a type D frame is indicated on Drawings. Install steel support frame furnished by equipment manufacturer, utilizing equipment anchor bolt templates and isolator height saving brackets. Provide springs as specified for type “A” isolator; static deflection shall be a minimum of 2 inches.

I. Fans (2000 rpm or higher) Air Compressors and Miscellaneous Equipment, mounted on grade: As specified for grade mounted boilers except furnish type C isolators.

J. Boilers mounted on grade: Install each unit on concrete housekeeping pad with sound isolation pad designed for applicable equipment loading. Unit shall be fastened to housekeeping pad to prevent any movement.

K. Air Handling, Air Conditioning Units, Floor Mounted Fans, and Cabinet-Installed Fans: Install entire casing including filters, mixing box, fan section, coil sections, etc., on a continuous, integral, structural steel base, as indicated. Furnish type A, B, or C frames, reinforced as necessary to prevent distortion of frame. Furnish isolator type A; static deflection shall be a minimum of l ½ inches.

L. Suspended Fans and Air Conditioning Unit Fan Coils and Unit Ventilators: Suspend each integral unit from overhead structure on steel spring and elastomer hanger isolators. Support deflection under rated load of 3/8 inch. Provide spring static deflection as follows:

Fan RPM	Min. Deflection
200 – 400	3 inches
400 – 700	2 inches
Above 700	1 inches

M. Pipe Isolation: Where indicated and as required, furnish and support each pipe from an isolator. Isolator for the first five support locations away from vibrating equipment shall have the same deflection as the equipment isolators. After that, isolators shall be a neoprene-in-shear type of size as recommended by manufacturer; except where indicated on Drawings, pipe hanger rod shall be furnished with a steel spring isolator and elastomeric element, with lower rod capable of 30 degrees total misalignment without contact on spring housing.

N. Seismic Restraints: Floor or pad mounted equipment that do not require vibration isolators, shall be bolted to floor or other support. Floor mounted equipment with vibration isolators shall be provided with lateral and vertical restraining devices on all sides of base to restrict displacement of equipment. On all sides of suspended equipment, provide bracing for rigid supports and provide aircraft cable restraints for resiliently supported equipment.

O. Ductwork, duct acoustical lining, manual volume dampers and flexible ducts: Do not reduce length of duct runs, duct acoustical lining, manual volume dampers and flexible ducts for economy.

P. Installation of flexible ducts at air inlets and outlets: Do not attach flexible ducts directly to air inlets and outlets unless a straight, smooth and uniform air flow can be achieved with sufficient space to make an elbow with a radius of at least three times the diameter of the duct. If sufficient space is not available to make such an elbow, provide a rigid elbow or a lined plenum.

Q. Placement of Air Devices: Do not relocate air devices without the Architect's approval.

3.02 EXAMINATION

A. Arrange for the services of a certified representative of isolation manufacturer to visit the Project site for inspecting installation of devices. In the event the isolators do not meet specified requirements perform necessary revisions. Submit a written report to the Architect, signed by above representative, indicating all devices are properly installed and are operating as specified or required by isolation manufacturer.

END OF SECTION

SECTION 23 05 53- MECHANICAL IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Marking and identification required on mechanical piping systems, ducts, controls, valves, apparatus, etcetera.

B. Related Requirements:

1. Division 01: General Requirements.

2. Section 23 05 13: Mechanical Basic Materials and Methods.

4. Section 23 20 13: Mechanical Above Ground Piping.

5. Section 23 30 00: Mechanical Air Distribution.

6. Section 23 80 00: Mechanical Equipment.

1.02 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00:

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 23 05 00

2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

3. APWA: Uniform Color Code.

Or

4. IAPMO: Uniform Plumbing Code (UPC).

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.02 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.03 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.05 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation	Length of Color Field	Size of Letter
¾ to 1 ¼-inch	8-inch	½-inch
1 ½ to 2-inch	8-inch	¾-inch

2 ½ to 6-inch	12-inch	1 ¼-inch”
8 to 10-inch	24-inch	2 ½-inch”
over 10-inch	32-inch	3 ½-inch

D. Colors: As indicated in schedule.

E. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etc.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

F. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels, as required by the Project Inspector.

G. Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Chilled water supply	Chill water supply	Green	White
Chilled water return	Chill water return	Green	White
Heating hot water supply	Heating hot water supply	Yellow	Black
Heating hot water return	Heating hot water return	Yellow	Black
Air conditioning condensation drain	A/C condensate drain	Green	White

2.06 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

a. Blue: Water.

b. Red: Electric power lines, cables, conduit and lighting cables. By Division 26.

c. Orange: Communication, alarm or signal cables. By Divisions 26 and 27.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gage, with heat and moisture resistant insulation.

2.07 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

A. Provide identification markers to locate air conditioning equipment above T-bar ceilings. Install 3/4 inch to one inch diameter colored self-adhesive dots to T-bar ceiling grid indicating point of access. The following identification markers shall be recorded on the project record documents:

1. Fire Damper and Combination Fire/Smoke Fire Damper: Red.

2. Manual Volume Dampers, Relief Dampers, Motorized Volume Dampers: Blue.

a. Supply air: Full dot.

b. Return air: Half dot.

3. Fan coil unit: Green.

4. Filter Location if separate from fan coil: Yellow.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 23 07 00 - MECHANICAL INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Condensate drain piping from air conditioning equipment.
2. High and Low temperature equipment.
3. Heating hot water supply and return piping.
4. Chilled water supply and return piping.
5. Refrigerant piping.
6. Supply and return air ducts for heating and cooling systems air ducts.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 23 05 00: Mechanical Common Work.
3. Section 23 05 13: Mechanical Basic Materials and Methods.
4. Section 23 05 53: Mechanical Identification.
5. Section 23 20 13: Mechanical Above Grade Piping.
6. Section 23 20 16: Mechanical Underground Piping.
7. Section 23 30 00: Mechanical Air Distribution.
8. Section 23 50 00: Mechanical Central Heating Equipment.
9. Section 23 80 00: Mechanical Equipment.

1.02 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM C167 - Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
2. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board.
3. ASTM C302 - Standard Test Method for Density and Dimensions of Preformed Pipe-Covering-Type Thermal Insulation.

4. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

5. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

9. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

12. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

13. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria.

B. Underwriters Laboratories Inc.:

1. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

2. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems .

2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

3. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Submit in accordance with Division 01 and Section 23 05 00.

1. Complete material list of items to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements.

3. Shop Drawings, catalog cuts and manufacturer's data indicating insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California quality standards for insulating materials.

4. Display sample cutaway sections.

5. Manufacturer's recommended method of installation procedures, which will become part of this Section.

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer and Installer, Materials, Fabrication, Execution, and Standard of Quality: Comply with provisions stated under Section 23 05 00: Mechanical Common Work and Section 23 05 13: Mechanical Basic Materials and Methods.

B. Test Ratings:

1. Comply with provisions stated under Section 23 05 00 and 23 05 13 with emphasis on ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, UL label or listing of satisfactory test results from the National Institute of Standards and Technology, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.

2. Furnish labels, legibly printed with the name of the manufacturer or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for installation. Flame spread index of not more than 25 and smoke developed rating not exceeding 50.

3. Tests shall be performed on each item individually when insulation, vapor barrier covering, wrapping materials, or adhesives are installed separately at the Project site.

4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

C. Regulatory Requirements: Insulation furnished and installed under this Section shall conform to the requirements of the California Building Code Parts 4, Mechanical Code, Part 5, Plumbing Code and Part 6, Energy Code.

D. All chemically based products such as sealers, primers, fillers, adhesives, etc. shall meet the California air quality regulations.

1.05 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 23 0500: Mechanical Common Work and 23 05 13: Mechanical Basic Materials and Methods.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General:

1. Piping insulating material shall be fire resistant, non-corrosive, shall not break, settle, sag, pack or disintegrate under vibration, nor absorb more than 1 percent moisture by weight.

2. Piping insulating material shall be furnished with thickness indicated in Table 1, unless otherwise noted on the drawings, and shall furnish thermal resistance in the range of R-4.0 to 4.6 in accordance with inch at 75 degrees F. For any other value of R, insulation thickness shall be calculated accordingly and submitted for review.

3. Asbestos in any quantity in insulating material is not permitted.

4. Provide insulation materials, adhesives, coatings, sealants, fitting covers, and other accessories with a fire hazard rating not to exceed 25 for flame spread, 25 for fuel contributed and 50 for smoke developed, except for materials listed as follows:

   a. Nylon anchors for installing insulation to ducts or equipment.

   b. Treated wood blocks.

5. Flame-proofing treatments subject to moisture damage are not permitted.

TABLE 1 - MINIMUM PIPING INSULATION THICKNESS (1)

Insulation Thickness Required (in inches)

Piping System Type	Temp. Range (degrees F)	Run-outs up to 2 (2)	1 and less	1.25 to 2	2.5 to 4	5 to 6	8 and larger
Space Heating Systems (Steam, Steam Condensate and Hot Water)							
Low Pres Temp	201 to 250	1.0	1.5	1.5	2.0	2.0	3.5
Hot Water	Up to 200	0.5	1.5	1.5	1.5	1.5	1.5
Service Water Heating Systems (recirculating, piping supply and return)							
Hot Water	Up to 180	0.5	1.0	1.0	1.5	1.5	1.5
Space Cooling Systems (Chilled water, Brine and Refrigerant)							
Chilled Water	40-60	0.5	0.5	0.75	1.0	1.0	1.0
Refrigerant	Below 40	1.0	1.0	1.5	1.5	1.5	1.5
Condensate Drain	½-inch Minimum insulation thickness.	0.5	0.5	0.5	0.5	0.5	0.5
From Air Conditioning Equipment:	Insulate condensate drain lines within building, in room, inside walls and above ceilings.	0.5	0.5	0.5	0.5	0.5	0.5

NOTES:

(1) For Underground HVAC Piping refer to section 23 20 16 Mechanical Underground Piping.

(2) For piping exposed to ambient temperatures, increase thickness by 0.5 inch.

(3) Run-outs to individual terminal units, not exceeding 12 feet in length.

B. Lagging Adhesives: Shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Insulation finished with canvas shall be provided with laps adhered in accordance to manufacturer's recommendation. A finish coat of same material shall be applied to entire outer surface of lagging cloth at coverage specified by manufacturer.

C. Canvas Jackets: Furnish 6 ounce in accordance with square foot minimum, 48 by 48 thread count canvas jacketing.

D. Insulation Jackets:

1. Exterior insulation exposed to weather shall be weatherproofed with Childers aluminum jacketing as basis of design, or Pabco, RPR, or equal. Jacketing shall be manufactured from 1100, 3105 or 5010 aluminum alloy with 3/16-inch corrugations. Smooth or embossed jackets may be permitted in special situations to match an existing installation. Jacketing shall be furnished with an integrally bonded moisture barrier over entire surface in contact with insulation. A minimum thickness of 0.016 aluminum jacketing is to be provided on ducts and piping. A minimum thickness of 0.020 shall be provided on tanks, equipment, and heat exchangers.

2. Insulated elbows, of 90 degrees and 45 degrees, with a nominal iron pipe size of ½-inch to 8-inch shall be provided with Childers aluminum Ell-Jacs insulation covers as basis of design, or Pabco, RPR, or equal, manufactured from 1100 aluminum alloy of 0.024-inch thickness. Insulated elbows with a nominal pipe size of 10 inches to 18 inches shall be provided with Childers 4-piece aluminum Ell-Jacs as basis of design, or Pabco, RPR, or equal.

3. Tees, Flanges, and Valve Insulation in Conjunction with Aluminum Jacketing: Furnish Childers Aluminum Special Fabrications Insulation Covers as manufactured by Childers Products Company, Pabco, RPR, or equal.

E. Adhesives: Adhesives shall be water based, UL Classified, meet the requirements of NFPA 90A and NFPA 90B, have been tested according to relevant ASTM requirements, and be acceptable to the State Fire Marshal. Name, type and method of installation shall be submitted for review.

F. Valve and Fitting Cover: When installed in conjunction with PVC jacketing, furnish Zeston 25/50 rated polyvinyl chloride fitting covers as manufactured by Johns Manville, Knauf Insulation, Speedline, or equal.

2.02 SPACE HEATING PIPING SYSTEM

A. General: Insulate steam, steam condensate return, and hot water space heating supply and return, including valves, strainers and fittings with insulation thickness as indicated on Table 1.

B. Materials:

1. Classes of Insulation:

a. Class A: Calcium silicate molded pipe insulation, suitable for service temperature up to 1200 degrees F, ASTM C533; Johns Manville Thermo-12 Gold, or equal. Fittings: diatomaceous silica thermal insulating cement.

b. Class B: Glass fiber molded pipe insulation suitable for service temperatures up to 850 degrees F. Pipe insulation shall be one piece, preformed, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be Johns Manville Micro-Lok, Knauf Redi-Klad 1000, Owens Corning FIBERGLAS Pipe Insulation SSL II-ASJ, or equal.

c. Class C: Flexible open-cell melamine (foam insulation) suitable for service temperature -150 degrees F to 400 degrees F. Thermal conductivity at 75 degrees F, K = 0.26. Pipe insulation, one-piece pre-formed, laminated to heavy non-reinforced PVC jacket, with locking track, factory installed to jacket, to snap insulation and jacket onto pipe. Similar to TechLite 079 Series as manufactured by Accessible Products Co., or equal. Installation shall comply with manufacturers recommendations.

d. Class D: Mineral fiber pipe insulation suitable for service temperatures up to 1,200 degrees F. Pipe insulation shall be one-piece, preformed up to 3 inches thickness, and provide a minimum R factor of 4.0 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be 8 pounds in accordance with cubic foot density by Roxul Techton 1200, Fibrex COREPLUS 1200, Industrial Insulation Group, LLC (IIG) MinWool-1200, or equal.

2. Locations and Class of Insulation Required:

TABLE 2 – LOCATIONS AND CLASS OF INSULATION REQUIRED

LOCATION	CLASS OF INSULATION
Boiler and Mechanical Equipment Room	A, B, C, or D
All Other Locations	A, B, C, or D

3. Fittings on indoor piping shall be covered with flush, hand-wrapped Class A, B, C, or D insulation, to match the adjoining pipe insulation and covered with polyvinyl chloride fitting covers: Zeston 2000 25/50 by Johns Manville, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal.

4. Adhesive: Fibrous Adhesive to bond calcium silicate to itself and non-porous surfaces.

2.03 COOLING PIPING SYSTEM INSULATION

A. General: Insulate chilled water supply and return piping and refrigerant piping.

B. Materials:

1. Classes of Insulation:

a. Class A: Expanded polystyrene pipe insulation, self-extinguishing type, either molded or extruded; Dow Chemical Co. STYROFOAM, ITW Insulation Systems XPS PIB, Foam-Control EPS, or equal.

b. Class B: Glass fiber molded pipe insulation ASTM C547. Pipe insulation shall be one piece, preformed, and provide a minimum R factor of 4 at 75 degrees F mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be Johns Manville Micro-Lok, CertainTeed Snap-On, Owens Corning FIBERGLAS SSL II-ASJ, or equal.

c. Class C: Expanded (foamed) urethane (polyurethane) or polyisocyanurate pipe insulation of self-extinguishing type molded or fabricated, Dyplast Products, LLC ISO-C1/2.0, ITW Trymer, Specialty Products & Insulation Co. Polyisocyanurate Pipe Insulation, Armacell Armalok, or equal.

d. Class D: Foamed plastic pipe insulation, self-extinguishing type, ASTM C534 Type 1 - tubular. Pipe insulation shall be one-piece preformed, flexible tubing type and provide a maximum K factor of 0.28 at 75 degrees F mean temperature. Pipe insulation shall be Armacell Armaflex, Aeroflex Aerocel, Rubatex INSUL-TUBE 180, or equal.

2. Locations and Class of Insulation Required: For thickness required, refer to Table 1 of this Section.

TABLE 3 – SERVICE, LOCATION AND CLASS OF INSULATION REQUIRED

SERVICE	LOCATION	CLASS OF INSULATION
Condensate drains from air conditioning equipment	Indoors at all locations including above ceilings and between stud walls	D
Refrigerant suction Liquid line as required	All locations except underground	D
All other piping, except underground	All locations except underground	A, B, C

3. Adhesives:

a. Polystyrene adhesives: Synthetic rubber and resin adhesives specifically designed to adhere extruded and expanded rigid polystyrene and urethane insulation to themselves and to other porous and non-porous substrates.

b. Vapor barrier laps and penetrations: Furnish protective coating and lagging adhesive on butt joints of foil-faced vapor barriers, and where pins and staples puncture facings.

2.04 LOW TEMPERATURE EQUIPMENT INSULATION

A. General:

1. Insulate water chillers, heat exchangers, air eliminators and similar equipment operating at reduced surface temperatures.

2. Do not insulate chilled water expansion tanks, and chemical feeders.

B. Materials:

1. Expanded polystyrene, 2-inch thick, self-extinguishing type, Dow Chemical Co.'s STYROFOAM, Owens Corning FOAMULAR, Foam-Control EPS, or equal, or 1½-inch thick expanded urethane (polyurethane) or polyisocyanurate, self-extinguishing type, Dyplast Products, LLC ISO-C1/2.0, ITW Trymer, Specialty Products & Insulation Co. Polyisocyanurate Pipe Insulation, or equal.

2. Canvas Jackets: 6 ounce in accordance with square foot minimum.

3. Vapor Barrier Laps and Penetrations: Furnish protective coating and lagging adhesive on butt joints of foil-faced vapor barriers and where pins and staples puncture facings.

2.05 DUCTWORK AND PLENUM INSULATION

A. General: Insulate ductwork and plenums with not less than the amount of insulation tabulated in Table 4, unless noted otherwise on the drawings. Insulation may be omitted under the following conditions:

1. Exposed return air ductwork in conditioned space.

2. Return air ductwork between wall studs inside an interior wall.

TABLE 4 - INSULATION OF DUCTS AND PLENUM

Duct Location	Insulation Type
Exposed interior round and oval supply air ductwork located at Gyms and MPR Stages	DW-1
Exposed interior rectangular supply air ductwork located at Gyms and MPR Stages	L-1
Exterior locations of Health Units and Clinics	DW-2
Exterior locations other than Health Units and Clinics	L-2
In walls, within floor/ ceiling spaces	F-1 or L-1 See note 3
Hot and cold plenums	F-2, DW-1 or L-2 See note 3
Attics, Garages, and Crawl Spaces, within unconditioned space or in basement	F-3 or L-2 See note 3

B. Insulation Types:

1. DW-1: 1-inch thick insulation sandwiched inside double-wall type ducts and fittings.

2. DW-2: 2-inch thick insulation sandwiched inside double-wall type ducts and fittings. Duct joints shall be waterproofed.

3. F-1: 1½-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

4. F-2: 2-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

5. F-3: 3-inch blanket fiberglass, factory-laminated with all-service jacket vapor barrier.

6. L-1: 1½-inch Internal duct lining.

7. L-2: 2-inch Internal duct lining.

C. Notes:

1. Minimum insulation provided shall be as required by the current California Mechanical Code Title 24 for the most restrictive condition.

2. Refer to the materials indicated in this section for external insulation & Internal Lining.

3. External insulation shall be replaced with internal duct lining (of equivalent thermal resistance value unless noted otherwise) where indicated on the drawings or specified elsewhere for sound attenuation.

4. Provide internal duct lining (1 ½-inch unless noted otherwise) where indicated on the drawings or specified elsewhere for sound attenuation.

5. All exterior insulated ductworks shall be water proofed at joints, seams and duct penetrations.

D. Materials:

1. Fire-Resistive Insulation Materials and Coatings: Submit State Fire Marshal pre-approved materials only.

2. Adhesives: See Paragraph 2.01.E for applicable products.

3. External Insulation: Provide glass fiber blankets that are factory-laminated with Foil Reinforced Kraft (FRK) vapor barrier facing; Johns Manville Microlite, Owens-Corning SOFTR Duct Wrap, Knauf Insulation Friendly Feel Duct Wrap, or equal. Provide a minimum installed R value as required by the CEC Building Energy Efficiency Standards; but not less than scheduled on Table 5:

TABLE 5

INSULATION OF DUCTS AND PLENUM INSTALLED

THERMAL RESISTANCE “R” VALUES

Type	Labeled Thickness (in inches)	Installed R Value ($hr.ft^2.°F/Btu$)

F-1	1 ½	4.2
F-2	2	5.6
F-3	3	8.3
DW-1	1	4.2
DW-2	2	5.6
L1	1 ½	6.0
L2	2	8.0

4. Internal Lining: Internal Lining shall be of the type that inhibits the growth of mold, mildew and fungi and shall not contain harmful VOC's or contain glass fiber. Approved Material:

   a. Polyester Duct Liner:

      1) Polyester duct liner shall be an engineered nonwoven, thermally bonded Polyester with a smooth and durable FSK facing.

      2) Polyester duct liner must be able to withstand a constant internal temperature up to 250°F must be compliant with Greenguard Environmental Institute and contain zero VOCs per ASTM D5116. Liner must comply with all applicable standards including ASTM E84, ASTM C411, ASTM C518, ASTM G21, NFPA 90A and 90B, and UL 181.

      3) Approved Manufacturer: Ductmate Industries "PolyArmor" duct liner or approved equal.

   b. Elastomeric duct liner:

      1) Closed-cell, sponge- or expanded-rubber materials. Elastomeric liner must be able to withstand a constant internal temperature up to 300°F and must comply with all applicable standards including ASTM E84, ASTM E96, ASTM C209, ASTM C534 - Type II sheet materials, ASTM C411, ASTM C518, ASTM G21, ASTM G22, NFPA 90A and 90B, and UL 181.

      2) Approved Manufacturer: Armacell LLC "AP Armaflex FS" duct liner or approved equal.

   c. Duct liner must be attached per manufacturer's requirements using a non-flammable, low VOC water-based adhesive. When applicable, apply a non-flammable, low VOC water-based lagging adhesive to the exposed leading edge of the insulation. Install fasteners per SMACNA HVAC Duct Liner installation instructions.

   d. Duct liner must be installed per SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible," Third Edition unless otherwise specified.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Except as specified herein, install material in accordance with recommendations of manufacturer. Do not install insulation materials until tests specified in other sections are completed. Remove foreign material such as rust, scale, or dirt. Surfaces shall be clean and dry. Maintain insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be provided and maintained, insulation shall be installed with a continuous, unbroken moisture and vapor seal. Hangers, supports, anchors, or other projections that are fastened to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. Surface finishes shall be extended in such a manner as to protect raw edges, ends, and surfaces of insulation.

D. Pipe or duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where fire-stop or fire-safing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in the following locations unless otherwise noted:

1. On vacuum return lines less than 50 feet long.

2. On unions, flanged connections or valve handles.

3. Over edges of any manhole, clean-out hole, clean-out plug, access door or opening to a fire damper, so as to restrict opening or identification of access.

4. Over any label or stamp indicating make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.02 INSTALLATION OF COOLING PIPING SYSTEM INSULATION

A. General: Chilled water supply and return piping, refrigerant piping and condensate drain lines, after having been tested, shall be cleaned and insulated.

B. Application: Insulation on chilled water lines, refrigerant suction lines and liquid lines, if indicated, and air conditioner interior drain lines shall be jacketed with fire-resistant vapor barrier of laminated aluminum foil consisting of 2 plies with glass-yarn reinforcing. Jacket joints shall be lapped and sealed with an approved adhesive. Insulation shall be secured with aluminum bands not less than 0.005-inch thick by ¾-inches wide, spaced not over 12-inch on centers, or as recommended by manufacturer.

1. Longitudinal Seams: Butt hinged sections of covering tightly together and seal down jacket flap with adhesive, or with factory-applied, self-sealing lap with pressure-sensitive sealer protected with release paper.

2. End Joints: Wrap joint with a 3-inch wide (minimum) self-sealing tape.

3. Fittings and Valves: Fittings and valves shall be covered with same material of same thickness as pipe insulation, sealed with an approved, vapor-sealing tape or compound and covered with Johns Manville Zeston polyvinyl-chloride cover, Knauf Insulation Proto PVC Fitting Cover, Speedline Polyco Smoke Safe, or equal.

4. Pipe hangers shall be insulated or attached to pipe by an insulating insert, butted between adjoining insulation sections.

C. Additional Jackets:

1. Exposed Indoor Insulation: Cover with 26 gage galvanized sheet metal jacket to 8 feet above floors, except in mechanical equipment rooms and accessible pipe tunnels.

2. Exposed Outdoor Insulation: In addition to canvas or fiberglass cloth cover, provide 0.016-inch thick aluminum jacket with 1-inch wide aluminum bands and seals. Install appropriate jackets on valves and fittings.

3.03 INSTALLATION OF LOW-TEMPERATURE EQUIPMENT INSULATION

A. General: Provide removable sections of insulation over parts of chillers and similar equipment requiring insulation and having removable heads or sections.

B. Exterior surfaces of chilled water system expansion tanks and chilled water pumps shall be insulated with not less than 2-inch thick expanded polystyrene or fiberglass, as specified. Fill spaces between insulation and equipment with granulated polystyrene or urethane to eliminate voids. Insulation shall be secured with metal band, and covered with one inch, 20 gage hexagon galvanized mesh and ¼-inch thick insulating cement toweled smooth. Cement surface shall then be covered with 0.002-inch aluminum foil applied smoothly and secured with suitable adhesive, and a layer of 6-oz. canvas.

C. Coat joints of polyurethane insulation with neoprene based contact adhesive. Adhesives furnished shall be approved by insulation manufacturer. Fill and seal external voids and seams with non-shrinking sealant.

D. Canvas Jacket: Cover completed insulation with canvas jacket tightly pasted to covering with lagging adhesive. Lap jacket seams a minimum of 1 ½-inch. Finish entire surface of canvas jacket with one brush coat of diluted lagging adhesive, Childers CP-50A, Foster 30-36, Mon-Eco Industries (MEI) Eco-Lag Adhesive, or equal, and heavy final coat of undiluted adhesive.

3.04 INSTALLATION OF DUCTWORK AND PLENUM INSULATION

A. External Covering:

1. Before installing duct insulation, sheet metal ducts shall be clean, dry, and tightly sealed at joints and seams, inspected pressure tested, and accepted by OAR/ Inspector.

2. Duct exterior insulation shall be firmly wrapped around ductwork with joints lapped a minimum of 2-inch. Insulation shall be securely fastened with 18 gage

copper-lined steel wire, or 16 gage soft-annealed galvanized wire spaced approximately 12-inch on centers and at loose ends, presenting a neat and workmanlike appearance. Where duct width is such that wiring will not fasten insulation firmly against duct an adhesive shall be furnished to fasten insulation to duct with wiring being installed at ends of insulation segment.

3. Insulation on ductwork transporting conditioned air, both supply and return, and outside air intake ducts when pre-conditioned, shall be furnished with a factory-applied, fire-resistant vapor barrier.

4. Exposed Ducts or Plenum:

a. Install insulation to ducts or plenum furnished with butt joints, without voids and with adhesive over entire surface of duct. Cover insulation with canvas jacket, fastened tightly to insulation with lagging adhesive. Install 2 finish coats of undiluted adhesive.

b. When installing jacket, finished covering shall be even and level, without humps, with constant diameters on round ducts maintained.

B. Interior insulation - lining:

1. Dimensions of ducts indicated are net inside dimensions and must include thickness of duct liners to obtain the required duct size.

2. Install insulation in square turns, where required, to cover interior surfaces before duct turns are installed.

3. Install lining material during fabrication of duct with sealed face only exposed to air stream.

4. Interior insulation in ducts or plenums shall not have exposed edges. Edges open to entering or leaving air streams shall be covered, secured in place and sealed with approved duct liner edge sealers.

5. Insulation shall be fastened to sheet metal with an approved fire-retardant adhesive, with minimum 90 percent coverage and edges firmly adhered.

6. Mechanical fasteners shall supplement the adhesive on top sections of ducts more than 12-inch wide and on sides of ducts more than 24-inch high and shall be spaced on 16-inch centers maximum. Fastener posts shall be cut off approximately ¼-inch from metal disc.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

END OF SECTION

SECTION 23 08 00- MECHANCICAL SYSTEM COMMISSIONING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for Commissioning (Cx) of HVAC systems and equipment including installation, start-up, testing, documentation, and training according to the Construction Documents.
2. Standard procedures for the execution of commissioning work shall be in conformance with Division 01, Section 01 91 13: General Commissioning Requirements. Coordinate work with the Commissioning Services Provider (CxSP).

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 01 45 23: Testing and Inspection.
3. Section 01 45 25: Testing, Adjusting, and Balancing for HVAC.
4. Section 01 79 00: Maintenance and Operations Staff Demonstration and Training.
5. Section 01 91 13: General Commissioning Requirements.
6. Section 23 05 00: Mechanical Common Work
7. Section 23 25 00: Mechanical Water Treatment.
8. Section 23 30 00: Mechanical Air Distribution.
9. Section 23 50 00: Mechanical Central Heating Equipment.
10. Section 23 80 00: Mechanical Equipment.
11. Section 26 05 00: Common Work Results for Electrical.
12. Section 26 05 13: Basic Electrical Materials and Methods.
13. Section 26 05 19: Low Voltage Wires (600 Volt AC).
14. Section 26 05 26: Grounding and Bonding.
15. Section 28 31 49: Carbon Monoxide Detection and Alarm Systems.
16. Section 26 05 86: Motors and Drives.
17. Section 26 08 00: Electrical Systems Commissioning.
18. Section 26 29 13: Adjustable Frequency Drives.
19. Project Commissioning Plan (CxP).

1.02 REFERENCES

A. Applicable codes, standards, and references: inspections and tests shall be in accordance with the following applicable codes and standards:

1. InterNational Electrical Testing Association – NETA.
2. National Electrical Manufacturers Association – NEMA.
3. American Society for Testing and Materials – ASTM.
4. Institute of Electrical and Electronics Engineers – IEEE.
5. American National Standards Institute – ANSI.
6. National Electrical Safety Code – NESC.
7. California Building Code – CBC.
8. California Electrical Code – CEC.
9. California Mechanical Code – CMC.
10. Insulated Cables Engineers Association – ICEA.
11. Occupational Safety and Health Administration – OSHA.
12. National Institute of Standards and Technology – NIST.
13. National Fire Protection Association – NFPA.
14. American Society of Heating and Air-Conditioning Engineers – ASHRAE

    (The HVAC Commissioning Process, ASHRAE Guideline).
15. Associated Air Balance Council – AABC (National Standards for Total System Balance).

1.03 SUBMITTALS

A. Submittals package shall include the following:

1. Commissioning required submittals in accordance with Division 01 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxSP via the OAR.
3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks (PEC) and Functional Performance Tests (FPT), at least six weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force clearly defined.
5. Installation and checklist documentation shipped with equipment and field checklist forms to be used by factory or field technicians.
6. Detailed manufacturer's recommended procedures and schedules for PECs, supplemented by Contractor's specific procedures, and FPTs, at least four weeks prior to the start of PEC.

1.04 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend the Cx meetings as required under Section 01 91 13 and Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Divisions 23 and 26 Sections has been successfully completed and tests, inspection reports, and Operation and Maintenance manuals required have been submitted and accepted. The start-up and PEC shall be completed and submitted to the Owner at least two weeks prior to beginning FPT.

1. Coordinate HVAC work with the work of other trades prior to scheduling of any Cx procedures.

2. Coordinate the completion of HVAC testing, inspection, and calibration prior to start of Cx activities.

1.05 QUALITY CONTROL

A. Comply with Division 01 quality control specifications.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

C. Comply with Section 01 45 25: Testing, Adjusting, and Balancing for HVAC.

1.06 EQUIPMENT AND SYSTEMS TO BE COMMISIONED

A. Split Systems.

B. Make Up Air Units, with gas fired heat and evaporative cooling.

C. Fan Coil Units.

D. Variable Volume and Temperature System.

E. Exhaust Fans.

F. Ventilators.

G. Pumps.

H. Water Heaters, Gas and Electric.

I. Boilers.

J. Air Handling Units.

K. Air Conditioning Units.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:

1. Provide test equipment as necessary for the testing of the equipment and systems to be commissioned.

2. Provide testing equipment and accessories that are free of defects and certified for use.

3. Provide testing equipment with current calibration labels as per NIST Standards.

4. Equipment shall be calibrated on the manufacturer’s recommended intervals with calibration tags affixed to the instrument. In the absence of calibration tags,

calibration documentation shall be submitted to the CxSP at least thirty days prior to use; this documentation shall include description and serial number of instrument and calibration data and date.

5. Testing equipment shall be maintained in good operating condition for the duration of the project.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:

1. Complete phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.

2. If modifications or corrections to the installed system(s) are required to bring the system(s) to acceptance levels due to Contractor's incorrect installation or defective materials, such modifications shall be made at no additional cost to the Owner.

3. Normal start-up services required to bring each system into full operational state:

a. Testing, motor rotation check, control sequences of operation, full and part load performance.

b. Commissioning shall not start until each system is complete and start-up has been performed.

B. Pre-Commissioning responsibilities:

1. Inspection, calibration and testing of the equipment required to commission the following systems:

a. HVAC System(s).

C. Commissioning Process Requirements:

1. Refer to Section 01 91 13: General Commissioning Requirements and related Sections for information on meetings, start-up plans, Pre-Functional and FPT, operations and maintenance data, training requirements, and other Cx activities.

3.02 PREPARATION

A. Provide certified HVAC technicians as required, with tools and equipment necessary to perform Cx activities specified.

B. Provide certified testing agency personnel and equipment factory representatives as require in the Cx plan and other related Sections.

C. Verify that work required in this Section and in Section 01 91 13 is complete prior to starting of FPT.

D. Verify that complete operational manuals have been reviewed and accepted by the CxSP as specified before starting FPT.

3.03 TESTING

A. Testing procedures shall include the following minimum information:

1. Test number.

2. Equipment used for the test, with manufacturer and model number and date of last calibration.
3. Date and time of the test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Identification of the system, subsystem, assembly, or equipment.
6. Conditions under which the test was conducted, including (as applicable); ambient conditions, set points, override conditions, status, and operating conditions that impact the results of the test.
7. Systems and assemblies test results and performance and compliance with contract requirements.
8. Issue number, if any, generated as the result of the test.
9. Name(s) and signature(s) of witnesses and the person(s) performing the test.

B. Contractor shall participate and perform Cx related testing requirements as specified.

C. General Requirements for Mechanical, Controls, and Testing and Balance:

1. Construction and Acceptance Phases:

a. Provide assistance to CxSP in preparing FPT procedures specified. Sample test forms are included in the project Cx Plan.

b. Develop full startup and initial checkout plan using manufacturer's start-up procedures and Cx checklists for commissioned equipment. Submit to CxSP for review and approval prior to startup.

c. During startup and initial checkout process, execute mechanical-related portions of PEC for the equipment and systems to be commissioned.

d. Perform and clearly document completed startup and system operational checkout procedure. Providing four copies of the results to the Owner.

e. Resolve any open punch list items before FPT. Air testing and balance shall be completed with discrepancies and problems remedied before FPT of respective air -related systems.

f. Provide skilled technicians to execute starting of equipment and to execute PFT. Ensure that technicians are available and present during agreed upon schedules and for sufficient duration to complete necessary tests, adjustments, and solutions to identified problems.

g. Maintain a log of events and issues of tests and related Cx activities. Submit handwritten reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests, and lists of completed tests as specified.

h. Correct open issues and re-test as needed to prove compliance with system operational standards.

i. Prepare Operation and Maintenance Manuals and provide training for the Owner maintenance personnel and end-users per Section 01 79 00.

j. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of Warranty and notify the Owner.

k. Execute simulated seasonal FPT, witnessed by the Owner and the CxSP, as specified. Document results and perform corrections as needed for system acceptance and make necessary adjustments to Maintenance and Operations Manuals and Record Drawings.

3.04 SENSOR CALIBRATION

A. Field-installed temperature, relative humidity, CO_2, pressure sensors, pressure gages, and actuators (dampers and valves) shall be calibrated using the methods described below. Calibration procedures shall be documented during execution of the Start-up and the PEC. Alternate methods may be used, if approved by the CxSP.

B. Test instruments shall have had a NIST certified calibration within the last 12 months. Sensors installed in the unit at the factory with provided calibration certification need not be field calibrated.

C. Sensors:

1. Verify that sensor locations are appropriate and away from causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that determine a temperature difference, make sure they are reading within 0.2 degrees F of each other.

4. For sensor pairs that determine a pressure difference, make sure they are reading within 2 percent of each other.

5. Calibration: Put the equipment in operation. Make a reading with a calibrated test instrument within six inches of the site sensor. Verify that the sensor reading (via the permanent thermostat or gage) is within the tolerance listed in the table below of the instrument-measured value. If not, calibrate or replace sensor.

6. Tolerances:

Sensor	Required Tolerance (+/-)
AHU wet bulb or dew point	2.0 degrees F
Outside air, space air, duct air temps	0.4 degrees F
Watt-hour, voltage, and amperage	1 percent of design
Pressures, air, water and gas	3 percent of sensor range (inc. design value)
Flow rates, air	10 percent of sensor range (inc. design value)
Flow rates, natural gas	5 percent of sensor range (inc. design value)

Relative humidity	4 percent
CO_2 monitor	100 ppm
Sound level	5 db - Type 1 meter (Per Calibrator Mfg.)
Domestic Hot Water Temperature	1.5 degrees F
Domestic Hot Water Pressures Water and Gas	3 percent of sensor range (inc. design value)
Flow Rates, Domestic Water	4 percent of sensor range (inc. design value)
Flow Rates	5 percent of sensor range (inc. design value)

3.05 ADJUSTING

A. Perform work required to rectify installations not meeting contract requirements at no additional cost to the Owner.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

C. If systems' Cx deadline, as defined in the Project Schedule, goes beyond the scheduled completion without resolution of the problem(s), the Owner reserves the right to obtain supplementary services or equipment to resolve the problem.

3.06 TRAINING

A. Provide training plan for systems to be commissioned as required in applicable Division 23 specification sections and Section 01 79 00.

END OF SECTION

SECTION 23 08 13 - MECHANICAL ENVIRONMENTAL CONTROLS AND ENERGY MANAGEMENT SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for the Commissioning (Cx) of the Environmental Controls and Energy Management System (ECEMS), and interfacing with other systems such as, lighting controls and HVAC systems interconnection, including installation, start-up, testing and documentation according to Construction Documents and Commissioning Plan (CxP).
2. Standard procedures for the execution of commissioning work shall be in conformance with Division 01, Section 01 91 13: General Commissioning Requirements. Coordinate work with the Commissioning Services Provider (CxSP).

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 01 45 23: Testing and Inspection.
3. Section 01 77 00: Contract Closeout.
4. Section 01 79 00: Maintenance and Operations Staff Demonstration and Training.
5. Section 01 91 13: General Commissioning Requirements.
6. Section 23 05 00: Mechanical Common Work.
7. Section 23 05 13: Mechanical Basic Materials and Methods.
8. Section 23 08 00: Mechanical Systems Commissioning.
9. Section 23 09 23: Mechanical Environmental Controls and Energy Management Systems.
10. Section 23 25 00: Mechanical Water Treatment.
11. Section 23 30 00: Mechanical Air Distribution.
12. Section 23 50 00: Mechanical Central Heating Equipment.
13. Section 23 70 00: Mechanical Air Handling Units.
14. Section 23 80 00: Mechanical Equipment.
15. Section 26 05 00: Common Work Results for Electrical.
16. Section 26 05 13: Basic Electrical Materials and Methods.
17. Section 26 05 19: Low Voltage Wires (600 Volt AC).
18. Section 26 05 26: Grounding and Bonding.
19. Section 26 05 86: Motors and Drives.
20. Section 26 08 00: Electrical Systems Commissioning.

21. Section 26 24 19: Motor Control Centers and Motor Control Devices.

22. Section 26 29 13: Adjustable Frequency Drives.

23. Project Commissioning Plan.

1.02 REFERENCES

A. The latest version of applicable codes, standards, and references: Inspections and tests shall be in accordance with the following applicable codes and standards, except as provided otherwise herein:

1. National Electrical Manufacturers Association – NEMA.

2. American Society for Testing and Materials – ASTM.

3. American National Standards Institute – ANSI.

4. California Electrical Code – CEC.

5. Occupational Safety and Health Administration – OSHA.

6. National Institute of Standards and Technology – NIST.

7. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). – Building Management and Energy Management Systems Commissioning, ASHRAE Guideline.

8. California Building Code – CBC.

9. California Mechanical Code – CMC.

10. InterNational Electrical Testing Association (NETA) Acceptance Testing.

1.03 SUBMITTALS

A. Submittals shall include the following:

1. Required Cx submittals in accordance with Division 01 Specifications.

2. Copy of the Architect's reviewed and accepted submittals to the CxSP via the OAR.

3. List of team members who will represent the CONTRACTOR in the Pre-functional and Functional Performance Testing, at least two weeks prior to the start of Pre-functional Equipment Checks.

4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, checklist documentation and field checklist forms to be used by factory or field technicians, and a copy of full details of OWNER-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of OWNER to keep Warranty in force, clearly defined.

5. Detailed manufacturer's recommended procedures and schedules for Pre-functional Equipment Checks, supplemented by CONTRACTOR's specific procedures, and Functional Performance Tests, at least four weeks prior to the start of Pre-functional Performance Tests.

6. System logic documentation and sequence of operations for review and approval.

7. Provide Level 1 passwords.

8. After facility's commission is complete, submit completed Pre-functional Equipment Checklists and Functional Performance Test checklists organized by system and by subsystem. Bind information in a single package. The results of failed tests shall be included along with a description of the corrective actions taken.

1.04 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend Cx meetings as required under Section 01 91 13, any other related Sections and the CxP.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Division 23 and 26 Sections have been successfully completed, and tests, inspection reports and Operation & Maintenance manuals required have been submitted and reviewed. The start-up and Pre-functional Equipment Checklists shall be completed and submitted to the OWNER's Authorized Representative (OAR) prior to the Functional Performance Tests.

1. Coordinate electrical work with the work of other trades prior to scheduling of any Cx procedures.

2. Coordinate the completion of electrical testing, inspection, and calibration prior to start of Cx activities.

3. Cx activities shall be scheduled in accordance with project's Section 01 91 13 and Cx plan.

1.05 QUALITY CONTROL

A. Comply with OWNER's Quality Control Specifications.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

C. Typical quality control procedures include but are not limited to the following:

1. Attend CxSP progress and coordination meetings.

2. Establish trend logs of system schedules as required in Section 23 09 23.

3. Demonstrate system operation and compliance with contract documents.

4. Manipulate systems and equipment to facilitate testing.

5. Provide instrumentation necessary for verification and performance testing.

D. Provide ECEMS technician(s) to work at the direction of the CxSP for software optimization assistance for a minimum of 8 hours. Refer to Part 3 for a description of the software optimization.

E. Compensation for Retesting: Compensate OWNER for site time necessitated by incompleteness of systems or equipment at time of Functional Performance Testing (FPT). Testing failures, which require on-site time for retesting, will be considered actual damages to the OWNER. Parties under contract with the OWNER who are affected by the retesting shall be included in the contract modification.

F. Allow sufficient time before final commissioning dates to complete electrical testing, inspection, and calibration to avoid delays in the commissioning process.

G. During the commissioning activities, provide labor and materials to make corrections when required, without undue delay.

1.06 COORDINATION

A. Coordinate the completion of electrical testing, inspection, programming and calibration prior to start of commissioning activities.

B. Coordinate factory field-testing per the requirements of this Section.

C. Coordinate commissioning efforts with CxSP prior to commencing any activities.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT

A. Equipment to be used in the commissioning process shall meet the following requirements.

1. Provide test equipment as necessary for start-up and commissioning of the EMS system.

2. Provide testing equipment and accessories that are free of defects and are certified for use.

3. Provide testing equipment with current calibration labels as per NIST Standards; Equipment shall be calibrated on the manufacturer's recommended intervals with calibration tags affixed to the instrument. In the absence of calibration tags, calibration documentation shall be submitted to the CxSP at least thirty days prior to use; this documentation shall include description and serial number of instrument and calibration date and time.

4. Testing equipment shall be maintained in good operating condition for the duration of the project.

5. Testing equipment shall be UL Listed.

B. Instrumentation required to verify readings and test the system and equipment performance shall be provided by the CONTRACTOR and made available to CxSP. Generally, no testing equipment will be required beyond that required to perform CONTRACTOR's work under contract documents.

2.02 TESTING AND AIR BALANCING AND COMMISSIONING

A. Provide a portable operator's terminal or hand-held device to facilitate testing, adjusting, and calibration of controls. This device shall support functions and allow querying and editing of parameters required for proper calibration and start up.

B. Connections shall be provided local to the device being calibrated. For instance, for VAV boxes, connection of the operator's terminal shall be either at the sensor or at the terminal box. Otherwise, a wireless system shall be provided to facilitate this local functionality.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Work prior to commissioning:

1. Complete phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.

2. If contractual modifications are required to bring the system(s) to acceptance levels, such modifications shall be made at no additional cost to the OWNER.

3. Normal start-up services required to bring each system into full operational state:

a. Testing, motor rotation check, control sequences of operation, full and part load performance.

b. Commissioning will not start until each system is complete and start-up has been performed.

B. Pre-Commissioning responsibilities:

1. Inspection, calibration and testing of the equipment required to commission the following systems:

a. Environmental Controls and Energy Management Systems.

b. Interface and connections of EMS system with lighting controls, electric utility meter, gas meter, photo voltaic system, or as otherwise indicated in contract documents.

C. Commissioning Process Requirements:

1. Refer to Section 01 91 13: General Commissioning Requirements and related Sections for information on meetings, start-up plans, Functional Performance Testing (FPT), operations and maintenance data, training requirements, and other Commissioning activities.

3.02 PREPARATION

A. Provide certified EMS technicians as required, with tools and equipment necessary to perform Cx activities specified.

B. Provide certified testing agency personnel and equipment factory representatives as required in the Cx plan and other related Sections.

C. Verify that work required in this Section and in Section 01 91 13 is complete prior to starting of FPT.

D. Verify that complete operational manuals have been reviewed and accepted by the CxSP as specified before starting FPT.

3.03 START-UP, TESTING, ADJUSTING, AND CALIBRATION

A. Work or systems installed shall be fully functioning prior to Demonstration and Acceptance Phase. Start, test, adjust, and calibrate work as described below:

1. Inspect the installation of devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.

2. Verify proper electrical voltages and amperages and verify that circuits are free from faults.

3. Verify integrity/safety of electrical connections.

4. For AHUs that use a throttled outside air damper position when minimum outside air is required, mark the minimum outside air damper position.

5. Coordinate with testing and air balance (TAB) subCONTRACTOR to obtain, Cx and fine-tune control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB CONTRACTOR, and note any TAB deficiencies in the ECEMS Start-up report:

a. Optimum duct static pressure setpoints for VAV air handling units.

b. Minimum outside air damper settings for air handling units.

c. Optimum differential pressure setpoints for variable speed pumping systems.

d. Calibration parameters for flow control devices such as VAV boxes and flow measuring stations.

6. Test, calibrate, and set digital and analog sensing and actuating devices. Test equipment shall be 50 percent more accurate that the filed device over the same range. Calibrate each instrumentation device by making a comparison between the ECEMS display and the reading at the device. (e.g., if field device is plus or minus 0.5 percent accurate, test equipment shall be plus or minus 0.25 percent accurate over the same range). Record the measured value and displayed value for each device in the ECEMS start-up report.

7. Check and set zero and span adjustments for transducers and transmitters.

8. Dampers and Valves:

   a. Check for adequate installation including free travel throughout range and adequate seal.

   b. Where loops are sequenced, check for proper control with overlap.

9. Actuators:

   a. Check to ensure that device seals tightly when the appropriate signal is applied to the operator.

   b. Check for appropriate fail position, and that the stroke and range is as required.

10. Check each digital control point by making a comparison between the control command at the central command unit and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the ECEMS display. Record the results for each devise in the ECEMS start-up report.

11. For outputs to reset other manufacturer's devices (for example, VSDs) and for feedback from them, calibrate ranges to establish proper parameters. Coordinate with representative of the respective manufacturer and obtain their approval of the installation.

12. Verify proper sequences by using the checklists to record results and submit with ECEMS start-up report. Verify proper sequence and operation of specified functions.

13. Verify that safety devices trip at appropriate conditions. Adjust setpoints accordingly.

14. Tune control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the ECEMS start-up report. Except from a startup, maximum allowable variance from setpoint for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted):

    a. Duct air temperature: plus or minus 1-degree F.

    b. Space temperature: plus or minus 2-degrees F.

    c. Hot water temperature: plus or minus 3-degrees F

d. Duct pressure: plus or minus 0.25 inches w.g.

e. Water pressure: plus or minus 1 psid.

f. Air flow control: plus or minus 5 percent of setpoint velocity.

g. Space pressurization: plus or minus 0.05 inches w.g.

15. For interface and DDC control panels:

a. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the record drawings.

b. Ensure that terminations are safe, secure and labeled in accordance with the record drawings.

c. Check power supplies for proper voltage ranges and loading.

d. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.

e. Check for adequate signal strength on communication networks.

f. Check for standalone performance of controllers by disconnecting the controller from the LAN. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.

g. Ensure that outputs and devices fail to their proper positions/states.

h. Ensure that buffered or volatile information is held through power outage.

i. With system and communications operating normally, sample and record update/annunciation times for critical alarms fed from the panel to the Operator Interface.

j. Check for adequate grounding of DDC panels and devices.

16. Operator Interfaces:

a. Verify that elements on the graphics are functional and are properly bound to physical devices or virtual points, and that hot links or page jumps are functional and logical.

b. Output specified ECEMS reports for review and approval.

c. Verify that the alarm printing and logging is functional and per requirements.

d. Verify that trends are archiving to disk and provide a sample to the CxSP and OWNER for review.

e. Verify that e-mail alarm annunciation is functional.

f. Verify that functionality of remote operator interfaces.

g. Verify that required third party software applications required with the bid are installed and are functional.

h. Verify proper interface with fire alarm, lighting control system, photo voltaic system, gas and electrical meters.

B. Submit start-up test report: Report shall be completed, submitted, and reviewed prior to Substantial Completion.

3.04 SENSOR CHECKOUT AND CALIBRATION

A. General Checkout: Verify that sensor locations are appropriate and are away from causes of erratic operation. Verify that sensor with shielded cable are grounded only at one end.

B. Calibration: Calibrate sensors using one of the following procedures:

1. Sensors Without Transmitters – Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor at various points across the range. Verify that the sensor reading (via the permanent thermostat, gage, or ECEMS) is within the tolerances specified for the sensor. Where sensors are subject to wide variations in the sensed variable, calibrate sensor within the highest and lowest 20 percent for the expected range.

C. Sensor Tolerance: Sensors shall be within the tolerances specified for the device.

3.05 COIL VALVE LEAK CHECK

A. Verify proper close off of the valves. Ensure that valve seats properly by simulating the maximum anticipated pressure difference across the circuit. Calibrate air temperature sensor on each side of coil to be within 0.5 degrees F of each other. Via the Operator Interface, command the valve to close. Energize fans. After five minutes observe air temperature difference across coil. If a temperature difference is indicated, and the piping surface temperature entering the coil is within 3 degrees F of the water supply temperature, leakage is probably occurring. If it appears that it is occurring, close the isolation valve to the coil to ensure the conditions change. If they do, this validates that the valve is not closing. Remedy the condition by adjusting the stroke and range, increasing the actuator size/torque, replacing the seat, or replacing the valve as applicable.

3.06 VALVE STROKE SETUP AND CHECK

A. For valve and actuator positions check, verify the actual position against the ECEMS display.

B. Set pumps to normal operating mode. Command valve closed, verify that valve is closed, and adjust output zero signal as required. Command valve open, verify position is full open and adjust output signal as required. Command the valve to various few intermediate positions. If actual valve position does not reasonably correspond, replace actuator.

3.07 ECEMS DEMONSTRATION

A. Demonstrate the operation of the ECEMS hardware, software, and related components and systems to the satisfaction of the CxSP and OWNER. Schedule the demonstration with the OWNER's representative two weeks in advance. Demonstration shall not be scheduled until hardware and software submittals and the start-up test report are reviewed. If the work fails to be demonstrated to conform with contract specifications, so as to require scheduling of additional site visits by the CxSP and OWNER's representative for re-demonstration, reimburse OWNER for reasonable local costs of subsequent CxSP site visits as detailed elsewhere in these specifications.

B. Supply personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etcetera. Contractor-supplied personnel shall be competent with and knowledgeable of project-specific hardware, software, and the HVAC systems. Training documentation and submittals shall be at the job site.

C. Demonstration shall typically involve small representative samples of systems and equipment randomly selected by the OWNER and CxSP.

D. The system shall be demonstrated following the same procedures used in the start-up test by using the Commissioning checklist. Demonstration shall include, but not necessarily be limed to, the following:

1. Demonstrate that required software is installed on ECEMS workstations. Demonstrate that graphic screens, alarms, trends, and reports are installed as submitted. Demonstrate directory structure and file system matches that submitted.

2. Demonstrate that points specified and shown can be interrogated or commanded (as applicable) from workstations, as specified, in less than the maximum response time.

3. Demonstrate correct calibration of input/output devices using the same methods specified for the start-up tests. A maximum of 10 percent of I/O points shall be selected at random by the CxSP or OWNER for demonstration. Upon failure of any device to meet the specified end-to-end accuracy, an additional 10 percent of I/O points shall be selected at random by CxSP for demonstration. This process shall be repeated until 100 percent of randomly selected I/O points have been demonstrated to meet specified end-to-end accuracy.

4. Demonstrate that DDC and other software programs exist at respective field panels. The DDC programming and point database shall be as submitted.

5. Demonstrate that DDC programs accomplish the specified sequences of operation including failure sequences.

6. Demonstrate that the panels automatically recover from power failure, as specified. Demonstrate alarms as specified.

7. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications. Demonstrate that the panels' response to LAN communication failures meets the requirements of these Specifications.

8. Identify access to equipment selected by CxSP or by the OWNER. Demonstrate that access is sufficient to perform required maintenance.

9. Demonstrate that required trend graphs and trend logs are set up per the requirements. Provide a sample of the data archive. Indicate the file names and locations.

E. ECEMS demonstration shall be completed and prior to Substantial Completion.

F. Tests successfully completed during the demonstration will be recorded as passed for the Functional Performance Testing (FPT) and will not have to be retested.

3.08 RESOLUTION OF DEFICIENCIES

A. Maladjustments, misapplied equipment, or deficient CONTRACTOR's performance may result in additional work being required for Cx acceptance.

1. Perform work required to correct the installations not meeting contract requirements at no additional cost to the OWNER.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

1. If the system's Cx deadline, as defined in the CxP, goes beyond the scheduled completion of Cx without resolution of the problem, the OWNER reserves the right to obtain supplementary services or equipment to resolve the problem.

3.09 ECEMS ACCEPTANCE PERIOD

A. After approval of the ECEMS demonstration and prior to contract close-out acceptance phase shall commence. Acceptance period shall not be scheduled until HVAC systems are in operation and have been accepted, required cleaning and lubrication has been completed (i.e., filters changed, piping flushed, strainers cleaned, and the like), and Testing and Balancing report has been submitted and reviewed. Acceptance Period and its approval will be performed on a system-by-system basis if mutually agreed upon by the CONTRACTOR and the OWNER.

B. Operational Test: At the beginning of the Acceptance Phase, the system shall operate properly for two weeks without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. At the end of the two weeks, forward the trend logs to the CxSP for review and acceptance. CxSP shall determine is the system is ready for Functional Performance Testing (FPT) and document any problems requiring CONTRACTOR attention.

1. If the systems are not ready for Functional Performance Testing (FPT), correct problems and provide notification to the OWNER's representative that problems have been corrected. The acceptance period shall be restarted at the mutually scheduled time for an additional one-week period. This process shall be repeated until CxSP issues notice that the ECEMS is ready for Functional Performance Testing (FPT).

C. During the acceptance period, maintain a hard copy log of alarms generated by the ECEMS. For each alarm received, diagnose the cause of the alarm, and list on the log for each alarm the diagnosed cause of the alarm, and the corrective action taken.

3.10 TREND LOGS

A. Configure and analyze trends required under Section 23 0923.

3.11 TREND GRAPHS

A. Trend graphs as specified in Section 23 09 23 shall generally be used during the acceptance phase to facilitate and document testing. Prepare controller and workstation software to display graphical format trends during the acceptance period. Trend graphs shall demonstrate compliance with contract documents.

B. Each graph shall be clearly labeled wit HVAC subsystem title, date, and times.

3.12 WARRANTY PHASE

A. Trending: Throughout the Warranty phase, trend logs shall be maintained as required for the acceptance period. Forward archive trend logs to the CxSP and OWNER for review. CxSP or OWNER will review these and notify CONTRACTOR of Warranty work required.

3.13 SOFTWARE OPTIMIZATION ASSISTANCE

A. Provide the services of an ECEMS technician at the project site to be at the disposal of the CxSP and OWNER. The technician is to make changes, enhancements, and additions to control unit or workstation software that has been identified by the CxSP or OWNER during the Construction and Commissioning of the project and that are beyond the specified contract requirements. The cost for this service to include a total of 40 hour will be included with the bid. Request for assistance shall be for contiguous or non-contiguous 8-hour days, unless otherwise mutually agreed upon by the CONTRACTOR, CxSP, and OAR. The OWNER Authorized Representative (OAR) shall notify CONTRACTOR two days in advance of each day of requested assistance.

B. The ECEMS technician provided shall be trained in the programming and operation of the controller and workstation software. If the ECEMS technician provided cannot perform every software task requested by the CxSP or OWNER in a timely fashion, provide additional qualified personnel at the project site as requested by the CxSP or OWNER.

END OF SECTION

23 09 23 - MECHANICAL ENVIRONMENTAL CONTROLS AND ENERGY MANAGEMENT SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Environmental controls and energy management systems, including equipment, materials, installation, start-up, testing, documentation and training according to construction documents. The project drawings establish the scope of HVAC controls work in conjunction with the scope of work indicated in Division 23. This Section complements the requirements of Division 23 and construction drawings for controls and system communications.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 01 45 23: Testing and Inspection.
3. Section 01 79 00: Maintenance and Operations Staff Demonstration and Training.
4. Section 01 91 13: General Commissioning Requirements.
5. Section 21 13 13: Fire-Suppression Sprinkler Systems.
6. Section 23 05 00: Mechanical Common Work.
7. Section 23 05 13: Mechanical Basic Materials and Methods.
8. Section 23 08 00: Mechanical Systems Commissioning.
9. Section 23 08 13: Mechanical Environmental Controls and Energy Management Systems Commissioning.
10. Section 23 30 00: Mechanical Air Distribution.
11. Section 23 50 00: Mechanical Central Heating Equipment.
12. Section 23 70 00: Mechanical Air Handling Units.
13. Section 23 80 00: Mechanical Equipment.
14. Section 26 05 00: Common Work Results for Electrical.
15. Section 26 05 13: Basic Electrical Materials and Methods.
16. Section 26 05 19: Low-Voltage Wires (600 Volt AC).
17. Section 26 05 26: Grounding and Bonding.
18. Section 26 09 23: Lighting Control Systems.

19. Section 28 31 49: Carbon Monoxide Detection and Alarm Systems.

20. Project Commissioning Plan (CxP).

1.02 REFERENCES

A. The latest version of applicable codes, standards, and references. Inspections and tests shall be in accordance with the following applicable codes and standards, except as provided otherwise herein.

1. International Electrical Testing Association – NETA.

2. National Electrical Manufacturers Association – NEMA.

3. American Society for Testing and Materials – ASTM.

4. Institute of Electrical and Electronics Engineers – IEEE.

5. American National Standards Institute – ANSI.

6. National Electrical Safety Code – NESC.

7. California Building Code – CBC.

8. California Electrical Code – CEC.

9. California Mechanical Code – CMC.

10. Insulated Cables Engineers Association – ICEA.

11. Occupational Safety and Health Administration – OSHA.

12. National Institute of Standards and Technology – NIST.

13. National Fire Protection Association – NFPA.

14. American Society of Heating, Refrigerating, and Air-Conditioning Engineers – ASHRAE
(The HVAC Commissioning Process, ASHRAE Guideline).

15. International Building Code – IBC.

16. International Mechanical Code – IMC.

17. InterNational Electrical Testing Association (NETA) Acceptance Testing.

1.03 SUBMITTALS

A. Provide in accordance with Division 01 and Section 23 0500: Mechanical Common Work.

B. Shop Drawings shall include but not limited to:

1. Cover page with legend, common notes, symbol schedule, and drawing index.

2. Complete point to point environmental controls and energy management network communication diagram(s) for Direct Digital Controls (DDC) of each system:

   a. Identify all components.

   b. Indicate conduit and wire characteristics, sizes and quantities.

   c. Provide bill of materials.

3. Floor plans showing control panels and intercommunication wiring.

   a. Show system(s) interface connections.

4. Valve Schedules where required.

5. Operations and Maintenance Manuals.

6. As-built submittal drawings.

7. Installation Instructions of each control device.

8. PC Workstation.

9. Software flow diagram of each unique system sequence of operation.

10. Software licenses and electronic keys.

11. Supplemental local or factory training schedule for post warranty support.

12. A complete list of recommended spare parts with pricing for the OWNER's use in keeping the environmental control system downtime to a minimum.

13. Composite CD-ROM with AutoCAD drawings in a ".dwg" format.

1.04 QUALITY CONTROL

A. CONTRACTOR shall have adequate experience installing systems of similar size and complexity with the control product line proposed for this project.

1. Qualifications of Installer: Minimum five years experience installing products and systems of similar scope and complexity.

2. Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and is trained on network applications.

3. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain a spare set of major parts for the system at all times.

4. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.

5. CONTRACTOR shall have participated in the commissioning of a minimum of 10 projects of similar magnitude to those needed for this project.

6. System startup and testing shall be performed under the direct observation of the Project Inspector and OAR.

B. Materials and equipment installed shall be new.

C. System installation shall not begin until Shop Drawings are submitted and reviewed by the Architect or Engineer of Record.

D. Components for Direct Digital Control (DDC) shall comply with ASHRAE standards.

E. The installer shall provide the system components required by code and for the life safety of the service personnel.

F. System shall be able to interface with open protocol BACnet systems.

G. Provide all ancillary components for the system to perform the required sequence of operations. Install, test and adjust the system accordingly.

H. System components shall operate per industry standards. The standards shall be as defined by ASHRAE, SMACNA, AABC, NEBB, TABB, and the literature of the manufacturers listed in this Section.

I. Provide field engineering tools including software and hardware needed for programing and/or modifying system controller and devices.

1.05 WARRANTY

A. Components, system hardware and software, and parts and labor shall be guaranteed against defects in materials, fabrication, and execution for three years from date of system acceptance. Provide labor and materials to repair, reprogram, or replace defective components at no charge to the OWNER during the warranty period.

B. Provide a list of applicable warranties for equipment and components, this list shall include warranty information, names, addresses, telephone numbers, and procedures for filing a claim and obtaining warranty services.

C. CONTRACTOR shall respond to OWNER’s request for warranty service within four hours of initial call to schedule a mutually agreeable time for service. Submit records of the nature of the call, the work performed, and the parts replaced or service rendered.

1.06 TRAINING

A. Provide a competent instructor who is factory trained and has comprehensive knowledge of system components and operations to provide full instructions to designated personnel in the

system operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems.

1. Provide four hours of onsite OWNER familiarization and training for the installed system. Training shall include system overview, time schedules, override commands, emergency operation, and programming and report generation. OWNER employees attending this training session shall be provided with the following documentation:

    a. As-built drawings of System layouts and point to point connection diagrams.

    b. System components cut sheets.

    c. Operations and maintenance data.

2. Programmer and maintenance training shall include database entry; trend logs application programs, diagnostic routines, reporting, failure recovery and calibration.

    a. Provide 24 hours of training as follows:

        1) Training session shall accommodate a minimum of 20 persons and be facilitated at CONTRACTOR's training facility, which should be no more than 50 miles from the Project Site.

            a) Training shall be delivered in 6 hours per session increments.

            b) Obtain OWNER's approval for training locations exceeding 50 miles. In such cases, the CONTRACTOR shall be responsible for transportation expenses.

            c) CONTRACTOR shall provide training computers for all attendees. Computers shall be ready for live training sessions.

        2) Training shall cover instruction, theory, and expose the trainees to system's features, components, architecture, operations, programming, report generation, communications, and any other pertinent information required for the operations and maintenance of the system.

        3) Each training session shall have an itemized agenda covering all aspects of the training to be covered in the sessions. CONTRACTOR shall obtain agendas approval from OWNER and Commissioning Agent.

        3) Instructor(s) shall give the trainees the opportunity to practice on simulated and actual (installed) systems.

        4) The training session shall cover, but not be limited to the following instruction modules or sessions:

            a) System Architecture:

(1) System layout and components interrelations and hierarchical structure.

(2) Controllers interfacing and functions.

(3) Server functionality and data management, error messages, and alarm conditions.

(4) Connectivity and communication losses.

(5) Replacement procedures for system components.

b) User Operations:

(1) Familiarization and navigation with the EMS operating System.

(2) Window panes, menus, navigation buttons, alarm response windows, system passwords and accessibility features and options, monitoring and managing data points (inputs, outputs, numeric values, time and date, strings).

(3) Views: Provide sufficient information as to train staff on how and where to access programs, functions, adjust or alter diagnostic points and related data, override messages, reports and actions taken.

c) Trending: Setting trend(s) intervals, accessing data trends and history logs for diagnosis points or groups, and reporting. Working with trended data graphical displays, including but not limited to hiding points, setting display types and colors, viewing and setting scales.

d) Graphics: Standard symbols and color codes, graphics customization, how and where to access and manage the system with the graphic displays, including changing points and values, using HOA switches and viewing results, mapping to or with other graphic sources and functions, including groups, navigation, sequence of operations, and displays and reports.

e) Alarms: Reading and interpreting alarms, acknowledging and silencing alarms, routing and setting priorities, viewing and responding e-mailed and paged alarms.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Environmental controls and energy management systems shall be approved products of Alerton

2.02 SYSTEM ARCHITECTURE

A. The system shall be capable of providing a peer-to-peer network of distributed stand-alone DDC controllers that meet ANSI/ASHRAE Standard 135 for open protocol communications.

B. A maximum of 32 controllers shall be connected to any one MS/TP bus. Minimum Speed of 38kb and can support 127 devices per COM port. Provide a minimum of 2 ports.

1. Provide a Building Automation System (BAS) that consists of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, WEB enable capabilities, and Wide Area Network (WAN).

2. The Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming, and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.

3. For Enterprise and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be provided and installed on a Microsoft Windows based computer. The Reports Server can be installed on the same computer as the Enterprise Server.

4. The system shall be a top-level 100/1000bT Ethernet network that utilizes BACnet/IP.

a. A sub-network of SDCUs using the BACnet MS/TP protocol shall connect the local, and stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

5. The system shall match the existing LonWorks IP, and/or Modbus TCP protocol.

a. Integration to existing Modbus RTU/ASCII (and J-bus), Modbus TCP, LonTalk FTT-10A, and Web Services shall be native to the NSCs. There shall not be a need to provide multiple NSCs or additional software to allow all three protocols to be natively supported.

b. A sub-network of SDCUs using LonTalk FTT-10A, and/or Modbus RTU protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

C. Only systems that use HTML 5 structured language are allowed.

D. The supplied computer software shall employ object-oriented technology (OOT) for representation of data and control devices within the system. For each global, system or unitary controller, provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3 with the ability to support data read and write functionality.

E. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed three seconds for network connected controllers or user interfaces.

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values.

2. There is no limit to the number of alarms that can be created or stored in system hardware for any point, up to the system capacity.

3. System shall generate configured alarms from single or multiple system conditions.

4. Alarms will be generated from an evaluation of the alarm condition, and presented to the user in a fully configurable order, by priority, time, and category,
   a. Alarm views shall be presented to the user upon logging into the system WorkStation and/or Webstation.

5. Program the alarm management system to create and report alarm events history; the alarm events history data base shall provide the option to select alarm cause and action notes associated with an alarm event. The alarm management system shall also generate checklists for operators' use when utilizing a suggested mode of troubleshooting.

6. Provide alarm event history for a feature use to permit assigning of events for resolution to OWNER staff. The system shall notify the user and assigned resolution personnel.

7. Alarms shall be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

F. The system shall be able to interface with subsystems that utilize ANSI/CEA-709.1: Control Network Protocol Specification.

2.03 EMS SERVER AND USER INTERFACE WORKSTATION

A. EMS Server: The EMS Server shall include a tower or rack mounted server with an Intel Xeon E5 2600 processor, 8 Gb RAM, RAID 1 configuration with two hot swap 2TB 7200 RPM SATA drive, DVDRW drive, keyboard, mouse, 27 inch LCD color display and the latest version of Microsoft Windows Server operating system software. The workstation shall connect to the network through an internal 1Gbps Ethernet interface card.

1. Software licensing shall be provided for local or remote unlimited simultaneous users of the system, unlimited future point expansion, user graphical display generation and non-vendor controllers. Licenses and electronic keys shall be included with the M&O manuals for project acceptance. Conditional Licenses will not be acceptable.

2. The system shall be programmed to email selected alarms to designated response personnel.

a. The ability to utilize email paging of alarms shall be a standard feature of the operating system's mail application interface (MAPI). No special software and no email client software must be running in order for the system to distribute emails.

b. The email notification shall be able to be sent to an individual user or a user group.

c. The NSC shall support the use of Web Services based on open standards, such as SOAP and REST. Use incoming third-party data (temperature forecast, energy cost) over the Web to determine site modes, scheduling, and programming.

3. Web-based operation shall be supported directly by the NSCs and shall not require additional software.

4. The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs.

5. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information shall be available in graphic or text displays stored at the NSC. Graphic displays shall feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

6. Programming in the NSC shall be either in graphical block format or line-programming format or both.

7. Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except the viewing of live tasks or values.

8. The programmer's environment shall include access to a superset of the same programming language supported in the SDCUs.

9. Provided NSC devices shall support both script programming language as well as the graphical function block programming language. For both languages, the programmer will be able to configure application software for custom program development, and write global control programs. Both languages will have debugging capabilities in their editors.

10. The system shall be able to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.

11. The system shall be capable providing views of graphical programming in live and real-time from Workstation(s).

12. The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.

13. Automatic detecting zone that may be excessively driving the reset logic and generate an alarm.

14. Readily allow operator removal of zones from reset algorithm.

15. Applications shall be able to be assigned different priorities and cycle times for a prioritized execution of different function.

16. The provided system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

17. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface shall be able to be configured to become a user’s “PC Desktop” – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, shall enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shut down the active alarm viewer and/or unable to load software onto the PC.

18. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.

19. Provide a Web Server to automatically convert system displays on the workstation to an Internet page. Internet page shall be readable from standard PC browsers. Acceptable browsers shall be latest version of internet explorer, Chrome, or Firefox. No additional plug-ins, programs, software, hardware, etc. shall be needed to access the Internet page. The server shall be a separate device to provide security protection for the building system from outside hackers.

    a. Coordinate individual system components IP addresses, switch port assignments, security settings such as but not limited to SNMP alarm delivery, HTTPS/SSL settings, VLAN assignment and authorized IP address ranges with the OWNER’s Information Technology Division. Coordination activities with ITD shall be executed through the OAR.

    b. Provide IP address label on the interior of each cabinet door or equipment.

    c. The system shall support the ability to notify school or OWNER designated personnel by SMS or Email messages, utilizing the OWNER’s mail server when problems or situations that require immediate attention arise.

20. Operator Workstation shall display data associated with the project as called out on drawings or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field

installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display data using three-dimensional graphic representations of mechanical equipment. System shall be capable of displaying graphic files, text, trend data and dynamic object data together on each display screen with animation of equipment operation.

21. Controllers shall be programmed using graphical software tools that allow connection of function blocks for visual sequencing of control logic. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall also show change of status on logic devices and countdown of timer devices in a graphical format.

22. Operator Tracking Log shall record operator changes to the system for future review. This shall include, but not be limited to setpoint changes, time schedule overrides, alarm limits, etc.

23. The system shall be equipped with a battery back-up source capable of providing 30 minutes of operation (computer and monitor) in the absence of normal power, to allow for an orderly shutdown and data back-up.

B. EMS Workstation: The EMS Workstation shall be an enterprise level tower with an Intel Core™ i7 or better processor, 16GB of RAM, 256 GB solid state drive, DVD drive, keyboard, mouse, 27 inch LCD color display and the latest version of Microsoft Windows professional operating system software. The workstation shall connect to the network through an internal 1Gbps Ethernet interface card.

2.04 GLOBAL CONTROLLER

A. Building controllers shall incorporate the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 100MHz), master slave token passing (MS/TP) LANs, a point-to-point (PTP/RS-232) connection and telephone modem.

B. Provide global control strategies for the system based on information from any point objects in the system. Programming shall be object-oriented using graphical control function blocks. Global strategies shall include, but not limited to unit scheduling, electrical demand limiting, optimized start-stop of equipment, central plan reset control, etc.

C. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative). Battery shall provide up to five minutes of powerless operation for orderly shutdown and data backup.

D. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.

E. Each building controller shall log a minimum 1,000 trend logs. Any point object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired. Archived data shall be available for use in third-party spreadsheet or database programs.

F. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes events such as analog object value changes, binary object state

changes and various controller communication failures. Each alarm may be automatically dialed out to a telephone pager or emailed to any Internet PC computer.

G. Provide a 1.5 KVA UPS with battery back-up capability to provide a minimum of 30 minutes of operation (computer and monitor) for orderly shutdown and data backup. Make connections and test the system for proper operation in the presence of the Project Inspector.

H. The global controller shall be equipped with ADR demand limiting capacity interface.

1. The system shall include 5 DI for interfacing to local utility ADR program. The 5 DI shall be located in a 24 X 24 X 6 NEMA 12 cabinet mounted in the MDF or IDF room. Upon closer of each DI the control system shall raise or lower (depend on system mode) global room temperature set point 1 degree (user adjustable).

2. The system shall also include a demand-limiting program that utilizes data from site utility meter. Features indicated below shall be available via a switchable graphical user interface in all operating stations:

a. Shed/Restore equipment in digital format shall include 5 data input points for interface to future ADR web appliance located in an MDF/IDF room. System server shall accept ADR command from utility service via web interface, and shall include at least 5 priority levels of equipment shedding. Load shedding on a given priority level shall include two methods. In one the loads shall be shed and restored in a “first-off/first-on” mode and in the other; the loads shall be shed/restored in a linear fashion.

b. Adjust operator selected control setpoints in analog format based on energy usage when compared to shed and restore settings.

c. Shedding may be implemented independently on each and every zone or piece of equipment connected to the system.

d. Status of every load shed shall be capable of being displayed on every operator terminal connected to the system. Statuses shall be displayed along with the English description of each load.

2.05 APPLICATION (system and unitary) DDC CONTROLLERS.

A. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0 to 10VDC, 0 to 5 VDC, 4 to 20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three inputs that accept pulses. Controller shall include support and modifiable programming for interface to intelligent room sensor with digital display, and set point adjustment and override button. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include a supply voltage to power external sensors.

B. Program sequences shall be stored in EEPROM or flash memory. No batteries shall be needed to retain logic program. Controller shall execute program sequences 10 times per second and be capable of multiple PID loops for control of multiple devices. Calculations shall be completed using floating-point math. Programming of application controller shall be completely modifiable in the field over the installed BACnet LANs or remotely via modem interface.

C. Central Plant Controllers shall interface to chiller gateways. Point objects shall reside in the central plant controller. Hand-Off-Auto switches shall be provided for direct wired output control circuits.

D. Controllers for VAV boxes shall include one onboard airflow sensor microprocessor driven and pre-calibrated at the factory. Pre-calibration shall be at 16 flow points as a minimum. Factory calibration data shall be stored in EEPROM. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. Calibration parameters shall be adjustable through intelligent room sensor with digital display, and set point adjustment and override button. Operator workstation, portable computers and special hand-held field tools shall not be needed for field calibration. Boxes shall be controlled using pressure independent control algorithms and flow readings shall be in CFM

E. Controllers for Dual Duct boxes shall include two onboard airflow sensors and function similar to the VAV box controller. Multiple VAV box controllers or controllers with remote airflow sensors are not acceptable.

F. CONTRACTOR shall provide a laminated wiring diagram for each control panel. Locate diagrams on interior side of control panel's doors.

2.06 TEMPERATURE SENSORS

A. Temperature sensors shall be 10K ohm thermistor factory-calibrated to within 0.5 degrees F, totally interchangeable with housings appropriate for the application.

B. Wall sensors shall be installed 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells filled with thermal compound. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

C. Intelligent room sensors shall be equipped with digital display, set point adjustment and override button. Smart room temperature sensor/thermostat shall incorporate PIR motion sensor, temperature display, set point adjustment and override button. Acceptable Manufacturers: Schneider Electric SE8600 series, Viconics VT8600 series, Sigler 8600 series or equal.

D. Room thermostat shall be BACnet capable, Acceptable manufacturers: Schneider Electric SE8600 series, Viconics VT8600 series, Sigler VT8600 series or equal.

2.07 CARBON DIOXIDE (CO_2) SENSORS

A. Sensors shall be wall mounted at a height of approximately 4 feet. Locate sensors adjacent to room thermostat.

B. Sensors are not permitted on marker boards, between shelving, in recesses or above heat producing equipment.

C. Sensors shall be furnished with a display window that provides continuous monitoring and sensor status readings, and with tamperproof cover.

D. Sensors shall be gold plated for long-calibration stability, be factory calibrated and certified for a minimum of five years.

E. CO_2 sensors shall be BACnet capable, acceptable manufacturers: Honeywell C7232A, Telaire Ventostat Wall Mount, Johnson Control CD-WRD-00-0, or equal.

2.08 WINDOWS AND DOOR SENSOR

A. Provide windows and door switches at every operable windows and door in controlled spaces. Each switch shall be connected to a DI point on the DDC controller. Each switch shall be wired independently. Wiring multiple switches in series shall not be acceptable. Acceptable Manufacturers: Illumra E3-MDCCP or equal.

2.09 HUMIDITY SENSORS

A. The humidity sensor shall be a solid-state device that is factory calibrated to provide a linear output with an accuracy of 3.0 percent from 0 to 90 percent RH. A metal fabric filter shall protect the humidity-sensing element.

B. Duct humidity sensors shall utilize a sampling tube enclosure that is accessible for maintenance personnel.

C. Room and duct sensors shall incorporate a temperature sensor in the same enclosure when required.

2.10 PRESSURE SENSORS

A. Differential and pressure sensors shall have a tensioned stainless steel diaphragm to form a variable capacitor that produces a linear output with an accuracy of 1.0 percent of full scale. The unit shall be able to withstand 10 PSIG over pressurization.

B. Differential pressure switches shall utilize a diaphragm operated snap-acting switch with a setpoint range of 0.05 to 2.0 inches WC.

2.11 CARBON DIOXIDE (CO_2) SENSORS

A. Carbon dioxide concentration levels shall be sensed by non-dispersive infrared technology. A corrosion-free sensing chamber shall be used for accurate, stable CO_2 sensing. An LCD shall display sensed CO_2 concentration.

B. Sensor shall be gold plated and have a range of 0-2000 PPM at +/- 5 percent accuracy for long-term calibration stability. Both analog and binary relay output circuits shall be available on the sensor. An automatic background calibration algorithm shall reduce required maintenance.

C. Acceptable Manufacturers: Telaire, Honeywell, Johnson Controls, or equal.

2.12 ELECTRONIC VALVES

A. Control Valves ½ inch to 2-inch shall be characterized stainless steel ball valves with actuators sized to close off against twice the maximum fluid pressure. Valve body shall be NPT screwed for 2-way or 3-way application. A push button release shall be provided for manual operation.

B. Control Valves 2 ½-inch and larger shall be butterfly type with actuators sized to close off against twice the maximum fluid pressure. Valve body shall be flanged for 2-way or 3-way application. Contacts shall be provided to mechanically indicate the full open and full closed position of the valve.

C. Valve control shall be accomplish with 2-10 VDC. All valve shall provide feedback signal to EMS/BMS for monitoring on GUI.

D. Acceptable Manufacturers: Belimo, Honeywell, Johnson Controls, Schneider Electric or equal.

2.13 DAMPER ACTUATORS

A. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.

B. Actuators shall be sized for 200 percent of the design torque requirements.

C. Damper actuators shall incorporate a release mechanism to manually position the damper for maintenance or emergency override.

D. Damper Actuators located outdoors shall have a clear plastic weather shield specifically designed for the application.

E. Damper motor control shall be with 2-10 VDC

F. Acceptable Manufacturers: Belimo, Honeywell, Johnson Controls, Schneider Electric, or equal.

2.14 CURRENT SWITCH

A. Current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. A multi-turn setpoint adjustment shall set the trip point status. An LED shall indicate the on or off status.

2.15 CONTROL RELAY

A. The relay shall be contained in a plenum rated NEMA 12 enclosure with a ¾" NPT conduit fitting. Coil voltage shall be 24 or 120 VAC with a contact rating of 10A. An LED on the enclosure cover shall indicate the relay is energized.

2.16 POWER SUPPLIES

Power supplies and panel assemblies shall be UL or NRTL listed.

2.17 ENCLOSURES

A. Controllers, power supplies and relays shall be mounted in Hoffman A-LP NEMA 12 enclosures or equal when located in an indoor environment.

B. Enclosures for outdoor applications shall be metal NEMA 4, Hoffman A-ALP, A-BLP or equal, and be mounted on the north exposure of the controlled unit.

C. Enclosures shall have hinged, locking doors with common keying (CAT-60) for control panel on the Project Site.

D. Enclosures shall have permanently affixed to the door an engraved nametag identifying the equipment served. The nametag shall be a minimum 1 inch by 3-inch with ½ inch lettering.

PART 3 – EXECUTION

3.01 CONTROLS INSTALLATION

A. Wiring methods for control system shall be as defined in the Division 26 specifications. Wire types shall conform to manufacturers' recommendations.

B. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Control panel assemblies must be UL listed.

C. Provide software and hardware required to provide controls and monitoring of diagnostic points indicated in specification Section 23 8000.

D. Coordinate with Division 26 electrical installer so that "Hand/Off/Auto" selector switches are installed to override automatic interlock controls when switch is in the "Hand" position. Safety shutdown interlock wiring shall disable the equipment regardless of the position of the H-O-A switch.

3.02 ROOM SENSORS INSTALLATION

A. Room sensors shall be wall mounted at a 48-inch height above finished floor. Room sensors are not permitted on outside walls, at chalkboards, between shelving, in recesses or above heat producing equipment. Coordinate with Division 26 for sensor or thermostat mounting adjacent to light switches.

3.03 COORDINATION

A. Coordinate the work with other aspects of mechanical, electrical, fire-life safety and security systems, controls, and photo voltaic systems to obtain a complete and operating system in accordance with the contract documents.

B. Meet with the OAR and school principal and other school staff to determine when each zone or building will be occupied, and to determine programming and scheduling of the heating, ventilating and air conditioning equipment.

C. CONTRACTOR shall contact OAR to coordinate for timely availability of VPN access point(s) form OWNER's Information Technology Division.

3.04 DDC CONTROL SYSTEM ADJUSTMENTS

A. Make adjustments under operating conditions to provide sequence of operation for each control system per design intent. If required operating conditions cannot be obtained prior to completion date of the contract due to outdoor seasonal temperatures, return to the job site when requested by the OWNER and re-adjust control system when outdoor temperatures will

permit proper operating conditions. Start re-adjustment within seven calendar days after notification.

3.05 PERFORMANCE AND ACCEPTANCE:

A. Test and calibrate each device including but not limited to the following for proper operation, connection, signal value or response.

1. Building Controllers.
2. Custom Application Controllers.
3. Application Specific Controllers.
4. Input / Output Devices. (Sensors, actuators and monitoring devices)
5. Operator Interfaces.

B. Verify that systems are standalone and operable upon network failure.

C. Verify that systems return to normal operation automatically upon resumption of network operation or return of power.

D. Test each system for functions of the required control sequence of operation either by normal control operation or forced operation as required. Log and submit results.

E. Test the network for connectivity, data transmission rates, input/output responses, and other appropriate parameters Failure modes, including network failure, individual control system failure, and power outages, shall be simulated and responses logged, with any effects on network operation noted and corrected.

F. Test each preprogrammed time and holiday schedule.

G. Commissioning requirements of Divisions 01, 23, and 26 apply to this Section.

H. Schedule of Responsibilities: Refer to Appendix A. The schedule identifies the responsibilities of the CONTRACTOR for the installation of the environmental controls and energy management system. Deviations and clarifications of this schedule only if allowed by the OAR, provided trade CONTRACTOR coordination and schedule requirements are met. Submit a record copy of the Schedule of Responsibilities to the OAR at the commencement of this Section's Work.

3.06 WIRING AND INFRASTRUCTURE

A. Provide necessary wiring, terminations, connections and conduit infrastructure for the complete system as indicated in the construction documents.

B. Exterior cables whether above or below ground level shall be rated for exterior applications. When entering a building provide a code sized pull box with necessary hardware to transition exterior rated cables to interior applications.

C. Underground EMS cables are permitted to be installed with lighting control wiring in underground applications. Provide innerduct to separate EMS cables from lighting control system cables.

D. Provide both labeling and record documentation for all EMS system cabling. A cable management schedule and diagram shall be provided at each system panel or cabinet, in addition to a complete cabling diagram to be provided at the head end equipment location.

1. The cable management spread file shall include the following:

a. Cable Schedule.
b. Cable Test Forms.
c. Cable Label sequence and nomenclature.
d. Network chart.

2. Cable numbering shall be based on a defined format which readily identifies cable type, and allows maintenance technicians to determine originating and terminating locations.

3. Present the data in an Excel spreadsheet that will operate on the latest Windows platform. Information shall be presented in paper and electronic formats.

4. A copy of the cable schedule in a transparent plastic sleeve shall be affixed in the interior side of the front door of each network cabinet or cables convergence hub points.

3.07 DATA LOGGING REQUIREMENTS

A. The system must be capable of storing the system's collected and diagnosis data for a minimum of seven days.

B. Program the system for a standard seven day schedule including holydays.

3.08 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project Site.

3.09 PROTECTION

A. Protect Work of this Section until Substantial Completion.

END OF SECTION

APPENDIX A

SCHEDULE OF RESPONSIBILITIES

	ITEM	FURNISH BY	INSTALL BY	POWER BY	CONTROL WIRING BY
1	Magnetic Motor Starters:				
	a. Automatic controlled, with or without HOA switches.	E	E	E	DDC
	b. Manually controlled	E	E	E	N/A
	c. Manually controlled furnished as factory wired unit equipment	M	M	E	E
	d. Special duty type (part winding, multi-speed, etc.)	M	See Note 1	E	See Note 1
	e. Adjustable frequency drives with or without manual bypass.	DDC	E	E	DDC See Note 2
	f. Domestic booster pump. Motor Controls	M	M	E	DDC
2	Line voltage contactors.	E	E	E	DDC
3	Control relay transformers (other than starters).	DDC	DDC	E	DDC
4	Control and Instrumentation panels	DDC	NI	E	DDC
5	Automatic control valves, automatic dampers and damper operators, solenoid valves, insertion temperature and pressure sensors including wells	DDC	M	E	DDC
6	Control interlock wiring between pumps, fans and air handling units and other miscellaneous mechanical equipment.	DDC	DDC	E	DDC
7	Duct Smoke Detectors	E	M	E	E
8	Dampers				
	a. Control Dampers	M	M	N/A	DDC
	b. Smoke Dampers and Combination Fire/Smoke Dampers	M	M	E	E
9	Airflow Stations with transmitter.	M	M	E	DDC
10	Air terminal devices (I.e., VAV and fan powered boxes).	M	M	E	DDC
11	Intelligent Devices and Control Units provided with packaged mechanical equipment such as: Large VAV and constant volume package units and Boilers.	M	M	E	NI
12	Intelligent Devices and Control Units not provided by equipment manufacturer such as: Air handling units, Heat pumps, AC units (small < 20 tons), Air terminal units (VAV boxes)	DDC	DDC	E	DDC
13	Intelligent Devices and Control Units provided with electrical systems such as: Occupancy / motion sensors, Lighting Control Panels, Switches and dimmers, Switch Multiplexing Control Units, Door Entry Control Units.	E	E	E	DDC
14	Gateways for proprietary non-BACnet equipment	M	M	E	DDC
15	Communications network devices such as Routers, Bridges and Repeaters.	DDC	DDC	DDC	DDC

Abbreviations	
DDC	DDC CONTRACTOR (controls CONTRACTOR)
M	Mechanical CONTRACTOR
E	Electrical CONTRACTOR
N/A	Not Applicable

Notes:

1. Magnetic motor starters (special duty type) shall be set in place under electrical division except when part of factory wired equipment, in which case they shall be set in place under mechanical division.
2. Where a remote motor disconnect is required in addition to the one provided integral to a Variable Frequency Drive (VFD), controls CONTRACTOR shall provide the necessary control interlock between the disconnects.

SECTION 23 30 00 – MECHANICAL AIR DISTRIBUTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Ductwork and appurtenances required for a complete air transmission and distribution system for the heating, ventilating, and air conditioning systems indicated on Drawings and as specified.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 09 90 00: Painting and Coating.
3. Section 23 05 00: Mechanical Common Work.
4. Section 23 08 00: Mechanical Systems Commissioning.
5. Section 23 05 13: Mechanical Basic Materials and Methods.
6. Section 23 05 48: Mechanical Sound, Vibration and Seismic Control.
7. Section 23 07 00: Mechanical Insulation.
8. Section 23 09 23: Mechanical Environmental Control and Energy Management Systems.
9. Section 23 80 00: Mechanical Equipment.

1.02 SUBMITTALS

A. Provide in accordance with Division 01 and Section 23 05 00: Mechanical Common Work.

B. Manufacturer's Data:

1. Complete list of items to be furnished and installed under this Section. Material lists that do not require performance data shall include manufacturer names, types and model numbers.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
3. Literature shall include descriptions of equipment, types, models, sizes, capacity tables or curves marked to indicate performance characteristics, electrical requirements, options selected, space requirements, including allowances for servicing, and other data. Data shall include name and address of nearest service and maintenance organization that regularly stocks repair parts. Listings of items that function as parts of an integrated system shall be furnished at one time.

4. Submit complete acoustical test reports showing that proposed products have been tested in accordance with latest editions of relevant ASHRAE and AHRI Standards (ANSI/ASHRAE Standard 70 for air inlets and outlets; ANSI/ASHRAE Standard 130 and AHRI 880 for terminal units) and will be suitable for operation in Project spaces with specified maximum noise criteria (NC) requirements. The results of all testing shall be certified by an independent testing agency and submitted to the ARCHITECT for approval. The submittal shall include a complete description of the test conditions, methods and procedures.

5. Submittals shall include a tabulation of proposed products, identification of Project spaces where proposed products are to be installed, maximum allowable NC for all Project spaces, and product NC (at specific design air volume) for all Project spaces.

6. Shop Drawings: Shop Drawings indicating methods of installation of equipment and materials, sizes and gages of ducts, and details of supports. Items to be covered shall include but not be limited to following:

   a. Layout of ductwork and equipment drawn to scale to establish that equipment will fit into allotted spaces with clearance for installation and maintenance. Indicate proposed details for attachment, anchoring to, and hanging from structural framing of building. Indicate vibration isolation units, foundations, supports, and openings for passage of pipes and ducts.

   b. Drawings indicating locations and sizes of sleeves and prepared openings for pipes and ducts.

   c. Typical details of supports for equipment and ductwork.

1.03 QUALITY ASSURANCE

A. Installer's and Manufacturer's Qualifications: Comply with provisions stated under Section 23 05 00: Mechanical Common Work.

B. Sound power level measurements and Manufacturers' NC value calculations shall be conducted in complete accordance with the latest version of ANSI/ASHRAE Standards 70 and 130 and AHRI 880.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with provisions stated in Section 23 05 00: Mechanical Common Work.

B. Ensure ducts are clean and free of dirt, dust, moisture, oils and other contaminants that can lead to poor air quality. Cover openings of ductwork with a self-adhering protective film. Film shall not leave a residue on metal after removal, and shall be highly resistant to tears and punctures.

1.05 COORDINATION

A. Coordinate activities in accordance with provisions of Section 23 05 00: Mechanical Common Work.

PART 2 – PRODUCTS

2.01 GENERAL

A. Unless otherwise noted, provisions, including amendments thereto, of the latest edition of the HVAC Duct Construction Standards of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) and the California Mechanical Code (CMC), are hereby made part of this Section.

B. Rectangular, round and flat oval ducts shall be manufactured and installed in accordance with requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA.

C. Sheet metal ducts shall be fabricated from galvanized steel, aluminum or stainless steel.

D. Galvanized steel ducts shall be fabricated of galvanized steel sheet, lock forming grade, conforming to ASTM A653 and A924.

E. Galvanized steel ducts gage thickness and permissible joints and seams of ductwork shall conform to requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA and the CMC unless noted otherwise on the drawings. The more stringent requirements shall prevail.

F. Button punch snap-lock seams, using Lockformer or equal, shall be permitted only in concealed areas using 20 and 22 gage galvanized steel ducts with screws added at the ends. Button punch snap-lock is not permitted for aluminum or duct lighter than 22 gage.

G. Ducts shall be reinforced in accordance with the latest edition of the SMACNA HVAC Duct Construction Standards: Cross-broken Duct: Duct sizes 19 inches wide and larger which have more than 10 square feet of unbraced panel shall be beaded or cross-broken. This requirement is applicable to 20 gage or less thickness and 3 inches w.g. or less pressure. For details, refer to SMACNA manual.

H. Round and Oval Galvanized Steel and Aluminum Ducts:

1. Round Spiral Ducts and Fittings: Fabricated from galvanized sheet steel shall be machine-formed spiral pipe with sealed spiral locking joints. Fittings shall be furnished with continuous corrosion-resistant welds. Provide gages of ducts and fittings recommended by manufacturer.

2. Details of seams and transverse joints for round duct and fittings shall conform to SMACNA standards.

3. Flat oval ducts shall be provided as indicated on the Drawings. Reference standard details in SMACNA manual.

4. Minimum duct wall thickness, and permissible joints and seams of ductwork for flat oval duct construction shall conform to requirements in the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA and the CMC. The more stringent requirements shall prevail.

5. These provisions apply for ducts furnished for indoor comfort heating, ventilating and air conditioning service only.

I. Flexible Ducts

1. Flexible duct shall be non-metallic, insulated for conditioned air supply and return. The flexible ducts shall be factory fabricated with exterior reinforced laminated vapor barrier, 1 ½-inch thick fiber glass insulation (K = 0.25 at 75 degrees F), encapsulated zinc-coated spring steel wire helix and impervious, smooth, non-perforated interior vinyl liner and factory fabricated steel connection collars. For the composite assembly, including insulation and vapor barrier, comply with NFPA Standard 90A or 90B and tested in accordance with UL Standard, UL 181. Non-insulated metallic ducts shall be provided for exhaust only.

2. Methods of installations, standards for joining and attaching, and supporting flexible duct shall conform to applicable provisions of SMACNA manual.

3. Specifications herein shall not supersede installation requirements by flexible duct manufacturer if those are more stringent.

J. Aluminum Ducts:

1. Material for aluminum duct shall be of 3003-H14 alloy aluminum sheets, with such designation embossed or stenciled on each sheet. Minimum tensile strength shall be 19,000 psi.

2. Aluminum duct thickness and permissible joint and seams shall conform to requirements of the latest edition of the HVAC Duct Construction Standards-Metal and Flexible of SMACNA, and CMC.

3. Aluminum ductwork shall be furnished to transport moisture-laden air from shower rooms, shower drying rooms, dishwashers and discharge ducts from evaporative condenser and cooling towers.

4. Unless otherwise noted, follow SMACNA Duct Construction Details for steel construction standards as indicated for unreinforced duct, reinforced duct, or cross-broken duct.

5. Button punch snap-lock seams on aluminum ducts are not permitted.

K. Fittings and Other Construction Details: Details of fittings such as elbows, turning vanes, branch take-off and connections, duct access doors, connections for grilles, registers and ceiling diffusers, flexible connector at fan, etcetera, shall conform to applicable provisions of this Section or SMACNA manual.

L. Duct Seam and Joint Sealant: Provide sealant for metal ducts at duct joints which are defined as transverse joints between duct sections including girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections, access doors and frames, and abutments to building structure. Also provide the same at duct seams which are defined as longitudinal joint between duct sections. Spiral lock seams in factory fabricated round or oval ducts are excluded.

1. Sealant for low-pressure ducts shall be: Design Polymerics DP1010 or DP1020, Childers CP-145A/CP-146 Chil-Flex, Foster's 32-19 Duct-Fas, Miracle-Kingco Glenkote Seal-Flex, Ductmate Industries PROseal or FIBERseal, or equal.

2. Provide sealing material for medium-pressure ducts as described in the SMACNA manual for those pressures.

3. Sealant materials shall comply with the flame spread and smoke developed rating of current CMC when tested in accordance with ASTM E84.

4. Sealant for exposed to weather ducts shall pass the Weather Resistance Test per ASTM G154 at 2000 hours QUV.

M. Restrictions:

1. Zinc-coated steel duct shall not be installed for ductwork transporting moisture-laden air. Flexible duct may only be furnished where specifically indicated on Drawings. Aluminum ducts shall not be installed for internal pressures above 2 inches of water.

2. Fiberglass duct is not permitted as a substitute for sheet metal duct.

2.02 DAMPERS

A. Manually Operated Volume Control Dampers:

1. VD-1, Rectangular: Multi-blade type, opposed blade operation, 16 gage galvanized steel blades; center pivoted on 3/8 inch diameter steel trunnions; interlocking edges; dampers shall be in own angle frame, full duct size as indicated on Drawings; frame of minimum 16 gage steel channel construction. Provide with damper operator and axles positively locked to blade. Ruskin MD35, Pottorff MD-42, Greenheck MBD-15 or equal.

2. VD-2, Round: Frame shall be constructed of not less than 20 gage galvanized steel, blades of not less than 20 gage galvanized steel channel construction with factory neoprene seals, ½ inch diameter axle shafts and locking hand quadrant. Ruskin MDRS25, Greenheck MBDR-50, or equal.

3. VD-3, Oval: Frame shall be constructed of not less than 14 gage galvanized steel channels with factory blade seals of not less than 12 gage galvanized steel with not less than ½ inch diameter axle shafts. Provide Ruskin standard construction for frame, blade and axle size, thickness and material variation. Provide adjustable locking hand quadrant. Ruskin CDO25, or equal.

B. Motorized Volume Control Dampers:

1. MVD-1, Rectangular: Multi-blade type opposed blade operation, 16 gage minimum steel channel frame construction; 16 gage galvanized steel blades center pivoted on ½ inch diameter steel trunnions. Interlocking edges. Dampers shall be in own angle frame. Full duct size as indicated on the Drawings. Provide with matching two position motorized actuator with linkages, 24VAC by Belimo, Honeywell, Invensys, or equal. Ruskin CD35, Pottorff CD-42, Greenheck VCD Series, or equal.

2. MVD-2, Round: Butterfly type constructed with minimum 20 gage galvanized steel frame with steel angle reinforcement on above 20-inch diameter. Blade shall be 14 gage minimum thickness. Neoprene seal to ensure air tightness in closed position. Furnish with matching two position motorized actuator with linkage 24 VAC by Belimo, Honeywell, Invensys, or equal. Ruskin CDRS25, American Warming and Ventilating (AMV) VC-25, Air Balance, Inc. AC530, or equal.

3. Electronic Damper Actuators: Belimo, Honeywell, Invensys, or equal.

   a. Sized for torque required for damper seal at load conditions.

   b. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.

   c. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. Actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.

   d. Power Requirements: As indicated on Drawings.

   e. Actuator Timing: Shall meet 15 seconds.

   f. Temperature Rating: Actuator shall have a UL 555S listing by damper manufacturer for 350 F.

   g. Auxiliary Switches: Provide for signaling, fan control, and position indications.

C. Automatic Fire Dampers:

1. FD, Fire Dampers: Shall conform to requirements of and be listed by State of California Fire Marshal and NFPA 90A. Dampers shall provide airflow resistance not to exceed 0.05 inch water gage static pressure at 900 fpm or 0.25 inch water gage at 2,000 fpm. Dampers shall be installed in required steel sleeve at each penetration of a rated partition.

   a. Vertical-mounted fire dampers: Fire damper shall be curtain type with blades removed from the air stream to allow for maximum free area. Dampers will be provided in factory sleeves as tested and listed by manufacturer. Dampers shall be rated for 1 ½ hours for installation in one or 2-hour partitions. Provide UL listed fusible links of adequate size and temperature rating. Dampers will be installed according to the manufacturer's recommended installation instructions provided with units. Provide suitable access for inspection and servicing of each damper. Pottorff VFD-10/VFD-10D Series, Ruskin IBD/DIBD Series, Greenheck FD/DFD Series, or equal.

   b. Ceiling fire dampers: Ceiling fire dampers shall be butterfly type with ceramic material to minimize heat radiation. Dampers shall be rated for one hour and shall be furnished as a part of an integral sleeve ceiling box that will accept air distribution, have a UL listed and pre-mounted hanger tabs. Dampers shall be installed according to the manufacturers recommended installation instructions. Pottorff CFD-15 Series, Ruskin CFD Series, Greenheck CRD-1 Series/CRD-2, or equal.

c. Combination fire and smoke dampers: Combination fire and smoke dampers shall be louver bladed type. Units shall be tested and listed under UL 555 and UL 555S. Rating 1 ½ hours for installation in one or 2-hour partitions. The seals shall be non-degradable steel to steel. Leakage shall not exceed 15 cfm/sq. ft. at one inch w.g. and shall be tested at 850 degrees F. Dampers shall be capable of being remotely controlled and reset for pressurization and smoke evacuation. Fire-releasing device shall be UL 33 listed melting fusible links. Dampers shall be provided in sleeves with pre-mounted non-stall motor actuators and dual-position indicators for remote annunciation, if required. The complete assembly shall be factory cycled and tested prior to shipment. Provide suitable access for inspection and servicing of each damper. Pottorff FSD-141 with non-stall motor, Ruskin FSD37 or FSD60 with electric fuse link Model EFL 200, with electric non-stall motor, Greenheck FSD Series, with non-stall motor, or equal.

2. Electronic Damper Actuators: Refer to Sub-paragraph 2.04.B.3.

D. Relief Dampers: Parallel multi-blade, counter balanced type with adjustable counter weights. Constructed of 20 gage galvanized sheet steel or extruded aluminum with solid stops all around. Bearings shall be dust proof, ball bearings. Damper shall open on a positive pressure of 0.01 inch within space and close to a backdraft. Interlocking edges shall prevent dust infiltration when closed. Air Balance, Inc., Pottorff, Ruskin, Metal Form Manufacturing Co. Inc., or equal.

E. Duct Access Panels: Provide factory fabricated access panels in ducts where required for servicing fire or smoke dampers, and at other locations as specified in this Section. Units shall consist of removable panel, gasketed and pressure sealed by controlled spring tension locks. Construct unit, including interior parts, of same material as duct. Units shall be constructed to be suitable for installation in systems of up to 5 inches water gage static pressure.

2.03 AIR DISTRIBUTION DEVICES

A. General:

1. Grilles, registers, diffusers and appurtenances shall conform to requirements specified herein and shall be of type and sizes as specified and indicated on Drawings. Performance shall be in accordance with ANSI/ASHRAE Standard 70 including airflow velocity, pressure, temperature, and sound measurements.

2. Sponge neoprene, rubber, vinyl or felt border gaskets shall be provided for surface-mounted registers, grilles or diffusers.

3. The noise generating characteristics of all specified grilles, registers, and diffusers shall be tested to, and comply with, all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project. Maximum Sound Levels of diffusers, grilles and registers shall be as follows:

Administrative office area:	NC 30
Classrooms:	NC 20
Libraries and other noise sensitive areas:	NC 25
Gymnasiums, cafeterias, lockers areas:	NC 30

4. Provide suitable frame types to match the ceiling types as specified or indicated on the Architectural Drawings.

5. Ceiling diffusers shall be provided with equalizing grids.

6. Ceiling mounted grilles, registers and diffusers shall be provided with a factory applied, baked enamel, dull finish, bone white to match acoustical ceiling tile.

7. Grilles or registers mounted on painted walls or other surfaces shall be furnished with a baked prime coat and finish painted in accordance with Section 09 9000: Painting and Coating.

8. Do not provide opposed blade dampers at diffusers and registers to balance the airflow, as they tend to create noise. Provide a manual volume damper at each branch take-off and also at branch duct to each diffuser and register upstream of the flexible duct connections. Air throw patterns shall be as indicated on the drawings.

9. Diffusers, registers and grilles indicated or scheduled on the drawings to comply with special requirements shall take precedence over the standard items specified.

B. Ceiling Diffusers - Round, Square, Rectangular:

1. CD-1 For non-classroom areas of less than 10 feet ceiling height only. Units shall be square or rectangular modular core type as indicated on the drawings. Anemostat QC Series, Krueger Model 1240, Price SMCD Series, or equal.

2. CD-2 For typical classrooms. Units shall be square plaque type. Anemostat PG Series, Krueger Model PLQ, Price SPD Series, or equal. The horizontal air discharge pattern shall be 360-degree radial type with factory installed blank-offs for three way, two way corner, two way opposite, or one way discharge pattern.

3. CD-3 For non-classroom areas of higher than 10 feet ceiling height. Units shall be square or rectangular louver faced type. Anemostat D Series, Krueger Model SH, Price SMD/AMD Series, or equal.

4. CD-4: Units shall be round, adjustable pattern, and surface-mounted type. Anemostat C-27, Krueger RM Series, Price RCDE Series, or equal.

5. CD-5: Units shall be adjustable linear slot type. Anemostat SLAD Series, Krueger Model 1900, Price AS Series, or equal.

C. Grilles - Return, Exhaust, Ceiling, Square, Rectangular:

1. GR-1 Acoustical Tile on Plaster Ceiling: Return and exhaust grilles shall be single deflection type with horizontal fixed face bars set at straight or 45 degree angle, ½ inch spacing and flush and flanged for surface mounting. Anemostat S3HD Series, Kruger Model S80/S85, Price 500/600 Series, or equal.

2. GR-2 Prefabricated Acoustical Tile Ceiling with Inverted Exposed T-Bars: Return and exhaust grilles shall be with single deflection horizontal fixed face bars, set at straight or 45 degree angle, ½ inch spacing and flush, lay-in panel type with

nominal overall dimension of 24-inch by 24-inch. Anemostat Type SAC3L Series, Krueger Model S80/S85, Price 500/600 Series, or equal.

D. Registers, Supply, Return, Wall:

1. WR-1: Sidewall supply register shall be double deflecting type with loose key-operated opposed blade volume control. Anemostat S2 Series, Krueger Model 80/880, Price 500/600 Series, or equal.

2. WR-2: Sidewall return register shall be single deflecting type with horizontal fixed face bars set at 45 degree angle flush and flanged for surface mounting and complete with loose key-operated opposed blade volume control. Anemostat S3 Series, Krueger Model S80/S85, Price 500/600 Series, or equal.

2.04 SOUND ATTENUATING EQUIPMENT - DUCT SILENCERS

A. Provide factory fabricated duct silencers of tubular or rectangular type, for high or low velocity service, with arrangements, sizes and capacities as indicated on Drawings. Construct silencers of galvanized steel with casing seams sealed or welded to be airtight at a pressure differential of 8 inches water gage between inside and outside of unit, and stiffen or brace as required to prevent structural failure or deformation at same condition, or audible vibration during normal operation. Filler material shall comply with the following:

Fire Safety Standards:	NFPA 90A and 90B
Temperature:	ASTM C411
Air velocity:	ASTM C1071, UL 181
Fire Hazard Classification:	ASTM E84, UL 723-Class 1, NFPA 255
Corrosion Resistance:	ASTM C739, C665
Fungi Resistance:	ASTM G21
Water Vapor Sorption:	ASTM C1104, less than 1 percent by weight

Formaldehyde, Phenoloc Resins or other Volatile Organic compounds: 0 percent.

B. Select and provide silencers from acoustical and aerodynamic rating tables based on actual test readings or interpolated values of such readings obtained from tests made by recognized independent laboratories. Tests shall be in accordance with ASTM E477.

C. Select and provide silencers for air pressure drops not exceeding those indicated on Drawings, and of types, sizes and models for which noise reduction values, dynamic insertion loss, in decibels reference 10 to 12 watts, are not less than indicated on Drawings.

2.05 ZONE TEMPERATURE CONTROL DEVICES

A. Variable Air Volume Control Terminals:

1. VAV-1: AHRI 880 certified, single duct, pressure independent, variable air volume control terminal with reheat coil, sound attenuators, multi-point flow sensor, electric actuators and electronic direct digital controls. The controllers shall comply with Section 23 0923: Environmental Control and Energy Management Systems. The coils shall be copper tubes with copper fins. Casings shall be 22 gage galvanized steel lined with minimum ½ inch, 1.5 pound density, foil faced insulation that complies with NFPA 90A and UL 181.

   Anemostat, Krueger, Price, or equal.

2.06 SMOKE DETECTORS

A. Refer to Section 28 3100: Fire Detection and Alarm.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 DUCTWORK

A. Construct ductwork according to details of fabrication and methods of support, as indicated in the SMACNA manuals and CMC, unless specified or indicated otherwise in this Section or on Drawings. In event of conflict, the most stringent requirement shall be provided.

B. Unless otherwise required, construct ducts to conform accurately to dimensions indicated and to be straight and smooth on inside, with joints neatly finished.

C. Duct dimensions indicated are net inside dimensions.

D. Where aluminum is welded, provide a minimum thickness of 16 gage, and use gas inert tungsten process of welding.

E. Anchor ducts to building structural slab, framing and roof decking and detail method of anchoring and fastening if not indicated on Drawings. Supports shall be seismically constructed as required by the latest edition of the SMACNA guidelines.

F. Construct and install ducts to be completely free from vibration under operating conditions.

G. Indicate on layout drawing, required for suspended ductwork, location of supports, loads imposed on each fastening or anchor, typical details for anchorage, and details for special anchorage for supports attached to metal roof decking.

H. Attach supports only to building structural framing members and concrete slabs.

I. Where supports are required between structural framing members, detail and install suitable intermediate metal framing.

J. Ducts transporting air-conditioned or heated supply air shall be insulated in accordance with requirements of Section 23 0700: HVAC Insulation.

1. Ducts exposed to weather shall be prefabricated double wall type from HVAC equipment through building envelope.

K. Ferrous angles and structural members and joining collars specified for construction and support of ductwork and plenums shall be primed with one heavy coat of required asphaltic aluminum paint before installation or fabrication. Metal surfaces shall be thoroughly cleaned before installation of paint. Galvanizing may be provided instead of painting. Installed duct hanger rods concealed in furred ceilings and walls are not required to be primed or painted.

L. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

3.03 DUCT CONSTRUCTION

A. Minimum ductwork gages, joints, reinforcing, and bracing of ductwork shall conform to SMACNA and CMC. The most stringent standards shall prevail. Additional bracing shall be provided to prevent objectionable panel vibration.

B. Button punch snap-lock seams, using Lock-former or equal, shall be permitted only in non-accessible areas using 20 and 22 gage galvanized steel ducts with screws added at the ends. Button punch snap-lock is not permitted for aluminum or duct lighter than 22 gage.

C. Provide longitudinal seams of the grooved snap lock, or Pittsburg and standing, sealed spiral or continuously welded.

D. Ferrous angles and structural members and joining collars specified for the construction and support of ductwork and plenums shall be primed with one heavy coat of asphalt aluminum paint before installation or fabrication. The metal surface shall be thoroughly cleaned before application of the paint. Galvanizing may be provided instead of painting. Installed duct hanger rods concealed in furred ceilings and walls is not required to be primed or painted.

E. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

F. S-type or drive-slip type girths or longitudinal seams shall not be furnished for ductwork installed outdoors or mounted on roofs.

G. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint.

3.04 DUCT ELBOWS AND TURNING VANES

A. Duct elbows, including supply, exhaust, and return, shall be provided with a centerline radius of 1.5 times duct width parallel to radius whenever possible; centerline radius shall not be less than width of duct parallel to radius.

B. Where space does not permit above radius, or where square elbows are indicated on Drawings, turning vanes shall be installed whether indicated on Drawings or not.

C. Turning vanes shall conform to SMACNA and CMC.

3.05 DUCT JOINTS AND SEAMS

A. Conditioned air supply ducts shall be furnished with joints and seams sealed, welded for air tightness, except spiral seam factory machine formed duct components. Spiral seam is exempted. Joints between slip-fit components may be assembled with all seams and joint connections fastened with screws.

B. Other ducts shall be furnished with joints and seams sealed by using sealant, taping, soldering, or welding. Ducts for grease hood exhaust shall be furnished with grease-tight welding or brazing on external surface for joints and seams. Fiberglass ducts shall be provided with a thermally activated closure system, Johns Manville Fortifiber Therm-Lock with Automatic Bond Indicator dots, or equal.

C. S-slip or drive-slip type girths or longitudinal seams are not permitted on exterior or exposed rooftop mounted ductwork.

D. Caulking, taping, or other joint or seam treatment shall be provided in accordance with recognized standards.

E. Seams around fan, coil housing and plenums shall be sealed with gaskets or sealing compound to provide an airtight assembly.

F. Stainless steel ductwork connected to range hoods and fume hoods shall be provided with grease-tight, gas tight welded seams, and shall be constructed and installed so that grease or other material cannot become pocketed in any portion thereof, and system shall slope downward toward hood not less than 1/4 inch per lineal foot. Gasketed flanged joints with sealing compound shall be used only at fan and fume hood connections.

G. Alternative duct connectors such as Ductmate Industries, Mez Industries, or equal may be used if the following conditions are met:

1. One of the specifically listed connectors is submitted and approved by the ARCHITECT and OAR.

2. The correct size connector, application, and gage of material conform to SMACNA Standards.

3. The connector is installed per manufacturer’s specifications.

3.06 DUCT TRANSITION

A. Slopes in sides of transition pieces shall be no greater than 1 to 5. Abrupt changes or offsets in duct system are not permitted, except when reviewed by the ARCHITECT.

3.07 DUCT TEST HOLES

A. Holes in ducts and plenums shall be provided for pilot or static tubes for obtaining air measurements to balance or check air systems. Holes shall be covered with neoprene gasketed sheet metal cover or plugged with a fitted neoprene plug chained to duct.

3.08 SOUND ATTENUATING EQUIPMENT

A. Install sound attenuators where required and indicated on Drawings. Refer to manufacturer's instructions for required installation.

3.09 FLEXIBLE CONNECTIONS

A. At points where sheet metal connections are installed to fans or air handling units, or where ducts of dissimilar metals are connected, a flexible connection of commercial grade, Duro Dyne Durolon, Ventfabrics Ventglas, Ductmate Industries Proflex, or equal, non-combustible material shall be installed and securely fastened by zinc-coated steel clinch-type bands or a flange type connection. Inlet and outlet openings shall be axially in-line, maximum deviation of centerline shall be less than 5 percent of diameter or shortest dimension of a rectangular inlet of fan or air handling unit, with system at rest. Duct end of connection shall be seismically restrained if more than 4 feet from last support.

3.10 AIR TERMINAL DEVICES

A. General: Install supply devices after ducts, plenums, and casings have been cleaned and blown free of small particles, as specified. Devices shall be aligned to be parallel to ceiling construction or walls and ceiling surfaces, and shall be pulled tightly to compress gaskets and to fit neatly against surfaces.

B. Diffusers: Support surface mounted ceiling diffusers from angles or channels resting on and fastened to ceiling construction. Do not support from ducts. Install lay-in diffusers on T-bar ceilings with hanger wires from each corner and not supported by ceiling structure. Provide sheet metal adaptor box above each diffuser to allow space for volume controller with round collars for connection to round ducts where indicated on Drawings. Fasten duct-mounted diffusers to duct collars.

C. Registers and Grilles:

1. Install wall supply registers at least 6 inches below ceiling, unless otherwise indicated. Locate return and exhaust registers 6 inches below ceiling unless otherwise indicated.

2. Support ceiling diffuser type inlets, registers, and grilles as required above for ceiling diffusers.

3. Fasten wall mounted and duct mounted registers and grilles to flanges of duct collars.

3.11 DAMPERS

A. Manually operated dampers, gravity dampers, fire dampers, and motor operated dampers shall be furnished and installed as specified and indicated. Upon completion of installation, dampers shall be checked, lubricated, and adjusted so that they operate freely, without binding. Dampers shall be of standard commercial manufacture, complete with damper frame. Where painting is required, they shall be shop finished unless otherwise noted.

1. Provide and install manual volume dampers per SMACNA standards to allow balancing per AABC, NEBB or TABB Procedures and Standards whether indicated on the drawings or not.

2. Balancing dampers shall be installed in main supply ducts from fan discharge plenums, where two or more ducts are connected to each plenum, although such balancing dampers may not be indicated. Each zone shall be provided with a manual volume damper. Sheet metal screws shall be installed through handles and into ducts to lock damper in place after test and balance.

3. Each supply, return, and exhaust branch shall be provided with manual volume dampers.

4. Do not provide opposed blade dampers at air inlets and outlets.

5. Each supply, return, and exhaust inlet or outlet shall be provided with a manual volume damper. This damper shall be a minimum of 5 feet upstream of the air outlet and inlets. An acoustic flexible duct should be provided between the outlet and inlet and the damper for concealed ducts.

6. Dampers installed in accessible locations shall be provided with locking and indicating quadrants. Ventfabrics Ventlok, Duro Dyne, Young Regulator Co., or equal.

7. Dampers installed in ductwork in furred ceiling spaces or in roof spaces with less than 30 inches of clearance below beams, joists, or other construction, and where access panels are not provided shall be furnished with damper rods extended below ceiling and terminated with a concealed damper regulation. Ventfabrics Ventlok, Young Regulator Co., Duro Dyne, or equal.

8. Dampers not identified as splitter, extractor, or butterfly dampers shall be of multi-louver type arranged for opposed blade operation. Damper shall be same dimension as adjoining duct and be tight closing. Blades shall not be greater than 9 inches. Dampers shall be not less than 18 gage steel.

9. Motor operated dampers shall be furnished by temperature control manufacturer as part of temperature control equipment and shall conform to requirements of Section 23 0900: HVAC Instrumentation and Controls.

10. Dampers shall be provided with accessible operating mechanisms. Where operators are exposed in finished portions of building, operators shall be chromium-plated with exposed edges rounded. Splitter dampers are not permitted unless specified and reviewed by the ARCHITECT.

11. Dampers shall not be installed in combustion air ducts.

12. Access panels shall be installed for access at each damper's operating mechanism.

3.12 FIRE AND SMOKE DAMPERS

A. Fire dampers or combination fire and smoke dampers shall be installed and accessible at duct penetrations of rated walls and partitions and as required by State Fire Marshal and NFPA 90A, 92A, 92B, and 101.

B. Fire dampers shall be sized, and adjoining duct enlarged, to assure full size air passage of connecting ductwork.

C. Install smoke dampers as indicated on Drawings and as required in ducts penetrating smoke isolation separations.

D. Fire dampers or combination fire and smoke dampers shall be electrically actuated, power open-fail close type, UL 555 and UL 555S classified for 1-1/2 hours.

E. Provide a service disconnect switch for each and every combination smoke and fire damper.

3.13 DETECTORS

A. Smoke detectors shall be installed in accordance with requirements of the California Mechanical Code.

B. Smoke detectors shall be installed in systems of over 2000 CFM capacity to detect presence of smoke and automatically shut down air handling units or fans unless it has been verified with the electrical installer that Exception 1 to CMC 609.0: Automatic Shutoffs, regarding automatic shutdown of systems with total coverage smoke detection systems is applied.

C. Smoke detectors shall be installed in supply system downstream of filters.

3.14 BACKDRAFT DAMPERS

A. Backdraft dampers shall be installed at locations indicated in accordance with the State of California Building Energy Efficiency Standards, Title 24, CCR.

3.15 DUCT SLEEVES AND PREPARED OPENINGS

A. Furnish duct sleeves for 15-inch diameter ducts or less passing through floors, walls, ceilings, or roof and install during construction of the floor, wall, ceiling, or roof. Install round ducts larger than 15 inches diameter and square and rectangular ducts passing through floors, walls, ceilings or roof through prepared openings. Provide duct sleeves and prepared openings for duct mains and duct branches.

B. Provide one inch clearance between duct and sleeve or between insulation and sleeves for insulated ducts, except at grilles, registers and diffusers.

C. Provide prepared openings for round ducts larger than 15 inches in diameter and for square and rectangular ducts with one inch clearance between duct and openings or between insulation and opening for insulated ducts, except at grilles, registers and diffusers.

D. Provide closure collar of galvanized sheet metal not less than 4 inches wide unless otherwise indicated on Drawings on each side of walls or floors where sleeves or prepared openings are provided except where grilles or diffusers are installed. Install collar tight against surface. Fit sharp edges of collar installed around insulated duct to preclude tearing or puncturing insulation covering vapor barrier. Fabricate collars from round ducts in steel. Provide not less than 4 nails to attach collar where openings are 12 inches in diameter or less and not less than 8 nails where openings are 20 inches in diameter or less.

E. Pack space between sleeve or opening and duct or duct insulation with commercial grade packing yarn.

3.16 FLEXIBLE DUCT RUNOUTS

A. Runouts from branches, risers or mains to air terminal units and outlets may be pre-insulated, factory fabricated flexible ducts complying with NFPA 90A. Flexible ductwork shall not exceed 7 feet in length. When required to suspend flexible ducts, furnish hangers of type recommended by manufacturers of pre-insulated flexible duct and install at intervals recommended. Method of attachment to other components of air distribution system for a vapor-tight joint shall be in accordance with printed instructions of flexible duct manufacturer. Bend radius shall be 1-1/2 times diameter of duct, measured from centerline. Bends greater than 90-degree angle are not permitted. Non-metallic flexible duct shall be permitted only in T-bar suspended ceilings.

3.17 DUCT HANGERS AND SUPPORTS

A. Exposed or easily accessible ductwork: All exposed ducts shall be supported by all-thread Rod as a single hanger and or a trapeze support for rectangular duct work in accordance with requirements of the latest edition of the HVAC Duct Construction Standards – Metal and Flexible of SMACNA.

B. Non-accessible ductwork: Non-exposed and hidden from sight during regular school operations ductwork, rigid round, rectangular, and flat oval metal ducts, shall be installed with support systems conforming to SMACNA Standards.

C. Where ducts are installed one above the other, they shall be individually supported on a trapeze of steel angles with 3/8 inch supporting steel rods securely fastened to overhead construction. A minimum distance of 3 inches shall be maintained between ducts wherever possible, but in no event shall distance be less than 2 inches. Minimum sizes of steel angles shall be 1 ½-inch by 1 ½-inch by 1/8 inch for duct sizes through 60 inches in greatest dimension, 2-inch by 2-inch by 1/8 inch for duct sizes 61 inches through 84 inches, 2-inch by 2-inch by 3/16 inch for duct sizes 85 inches through 96 inches, and 2-inch by 2-inch by 1/4 inch for duct sizes over 97 inches.

D. Ducts six square feet area and greater and or minimum 28” round or greater shall be seismically restrained. Refer to Section 23 0548: HVAC Sound, Vibration and Seismic Control.

E. Hangers shall not be supported by, or fastened to, non-structural members including blocking. Toggle or Molly type bolts are not permitted.

F. Vertical ducts shall be supported with suitable angles on each side of each duct located at each floor and at intervals not to exceed 8 feet. Angles shall be sized and installed according to SMACNA Standards for required span so that they will be rigid, without bending or sagging.

G. Roof-mounted ductwork shall be installed a minimum 12 inches above roof and shall be supported by galvanized welded pipe, one on each side, fastened to roof structure, flashed and sealed to roof membrane. Install supports at each turn, unit connections, and each penetration, and space at maximum 6 feet off-center in general. Pitch pockets are not allowed.

3.18 ACCESS PLATES AND DOORS

A. Access plates and doors shall be furnished and installed where stops, valves, fire dampers, fusible links, coils, damper operating mechanism, control equipment, lubrication fittings, air filters, air handling equipment and similar items normally requiring adjustment or servicing are installed in concealed spaces.

B. Access plates and doors shall be located to permit convenient access to equipment sized to permit removal of equipment for servicing. Access plates shall be no less than 12-inch by 12-inch in clear opening. Proper servicing of equipment requires adequate access for maintenance personnel. Access doors shall not be less than 24-inches by 24-inch, unless otherwise detailed. Two or more valves shall not be located in same access area unless sufficient clearance is provided for operation, servicing and removal of each valve.

C. Openings in ducts or plenums whose longer dimension does not exceed 12 inches may be covered by a plate of same material as duct, gasketed and fastened to duct or plenum with sheet metal screws.

D. Access plates in floors shall not be less than 8-inch by 8-inch and shall be carborundum surface brass with cast brass frames anchored into concrete. Access plates in tile walls shall be chromium plated brass and polished. Serrated plates furnished as part of a clean-out assembly are permitted in floors instead of a separate plate.

E. Access plates and doors in walls and ceilings of finished rooms and in locations normally accessible to students shall be furnished with continuous piano hinges, unless otherwise specified, and a special flush type spring-loaded latch requiring an Allen wrench to operate. Access devices shall be installed after plastering in plaster ground openings.

F. Access panels or doors penetrating one-hour fire resistive ceilings shall meet code requirements for such openings.

G. Access panels shall be fire-rated; Milcor, or equal. Access doors shall be as required for installation in openings penetrating one-hour fire resistive ceilings. Access doors shall be furnished with a flush, key-operated cylinder lock, furnished with two keys each, instead of Allen headlock for non-rated ceilings.

H. Access panels that are part of an integrated ceiling are specified in Section 09 8433: Cementitious Wood Fiber Acoustical Units. Identification markers shall be affixed to adjacent supports, under this portion of Work, to indicate location and type of mechanical device to be serviced.

I. Access panels installed in ducts or plenums located in heater or equipment rooms containing gas-fired equipment shall be furnished with heavy-duty spring closing hinges and refrigerator door type catches unless otherwise required. When these panels are intended for maintenance personnel access, catches shall be operable from both interior and exterior.

J. Other access panels, except those specified above, shall be furnished with suitable hinges and one or more sash fasteners.

K. Panels located in ducts and plenums shall be installed with gaskets made of synthetic rubber, felt, or similar material to provide an airtight installation. Panels shall be constructed and reinforced to prevent vibration.

L. Label the words "FIRE DAMPERS" on panels over fire dampers and words "DO NOT OPEN - HEATER IS OPERATING" on panels located in heater or equipment rooms. Letters shall be approximately 3 inches high, if space is available.

M. Furnish a key to operate latch access plates, one for each access plate, but not to exceed five keys for any one Project.

N. Access plates and panels shall be furnished with manufacturer's name or trade mark and model number cast or stamped thereon, or upon a label permanently affixed thereon.

O. Provide duct through roof flashing as detailed in the SMACNA standards or as indicated on Drawings.

P. Refer to SMACNA for access plate and door construction.

3.19 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

3.20 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

END OF SECTION

SECTION 23 31 - METAL DUCTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. Section Includes:

1) Single-wall round ducts and fittings.

2) Sheet metal materials.

3) Sealants and gaskets.

4) Hangers and supports.

b. Related Sections:

1) Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.3 PERFORMANCE REQUIREMENTS

a. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1) Static-Pressure Classes:

a) Exhaust Ducts (Negative Pressure): 1-inch wg.

1.4 SUBMITTALS

a. Product Data: For each type of the following products:

1) Sealants and gaskets.

b. Shop Drawings:

1) Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2) Factory- and shop-fabricated ducts and fittings.

3) Duct layout indicating sizes, configuration, liner material, and static-pressure classes.

4) Elevation of top of ducts.

5) Dimensions of main duct runs from building grid lines.

6) Fittings.

7) Reinforcement and spacing.

8) Seam and joint construction.

9) Equipment installation based on equipment being used on Project.

10) Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

11) Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

c. Delegated-Design Submittal:

1) Sheet metal thicknesses.

2) Joint and seam construction and sealing.

3) Reinforcement details and spacing.

4) Materials, fabrication, assembly, and spacing of hangers and supports.

5) Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

d. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1) Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2) Suspended ceiling components.

3) Structural members to which duct will be attached.

4) Size and location of initial access modules for acoustical tile.

5) Penetrations of smoke barriers and fire-rated construction.

6) Items penetrating finished ceiling including the following:

a) Lighting fixtures.

b) Air outlets and inlets.

c) Sprinklers.

d) Access panels.

e) Perimeter moldings.

e. Welding certificates.

f. Field quality-control reports.

1.5 QUALITY ASSURANCE

a. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

b. Welding Qualifications: Qualify procedures and personnel according to the following:

1) AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2) AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

3) AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

c. Mockups:

1) Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a) Five transverse joints.

b) One access door(s).

c) Two typical branch connections, each with at least one elbow.

d) Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2) Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 PRODUCTS

2.1 SINGLE-WALL ROUND DUCTS AND FITTINGS

a. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1) Manufacturers: Subject to compliance with requirements, provide products by one of the following

a) Lindab Inc.

b) McGill AirFlow LLC.

c) SEMCO Incorporated.

d) Sheet Metal Connectors, Inc.

e) Spiral Manufacturing Co., Inc.

f) Or Equal.

b. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).

c. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1) Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

d. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1) Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2) Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

e. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

a. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

b. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

c. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

d. Factory- or Shop-Applied Antimicrobial Coating:

1) Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.

2) Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3) Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.

4) Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

5) Shop-Applied Coating Color: Black.

6) Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

e. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1) Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

f. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT AND GASKETS

a. General Sealant and Gasket Requirements:

1) Duct Mastic shall be used at all duct joints and seams.

2) Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

b. Two-Part Tape Sealing System:

1) Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2) Tape Width: 6 inches.

3) Sealant: Modified styrene acrylic.

4) Water resistant.

5) Mold and mildew resistant.

6) Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7) Service: Indoor and outdoor.

8) Service Temperature: Minus 40 to plus 200 deg F.

9) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

c. Water-Based Joint and Seam Sealant:

1) Application Method: Brush on.

2) Solids Content: Minimum 65 percent.

3) Shore A Hardness: Minimum 20.

4) Water resistant.

5) Mold and mildew resistant.

6) VOC: Maximum 75 g/L (less water).

7) Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8) Service: Indoor or outdoor.

9) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

d. Solvent-Based Joint and Seam Sealant:

1) Application Method: Brush on.

2) Base: Synthetic rubber resin.

3) Solvent: Toluene and heptane.

4) Solids Content: Minimum 60 percent.

5) Shore A Hardness: Minimum 60.

6) Water resistant.

7) Mold and mildew resistant.

8) VOC: Maximum 395 g/L.

9) Maximum Static-Pressure Class: 10-inch wg, positive or negative.

10) Service: Indoor or outdoor.

11) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

e. Flanged Joint Sealant: Comply with ASTM C 920.

1) General: Single-component, acid-curing, silicone, elastomeric.

2) Type: S.

3) Grade: NS.

4) Class: 25.

5) Use: O.

f. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

g. Round Duct Joint O-Ring Seals:

1) Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2) EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3) Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

a. Duct supports shall be per DSA approved drawings.

b. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

c. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

d. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

e. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

f. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

g. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

h. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

i. Trapeze and Riser Supports:

1) Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2) Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3) Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 SEISMIC-RESTRAINT DEVICES

a. Shall be per DSA approved plans.

PART 3 EXECUTION

3.1 DUCT INSTALLATION

a. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

b. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

c. Install round ducts in maximum practical lengths.

d. Install ducts with fewest possible joints.

e. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

f. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

g. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

h. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

i. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

j. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

k. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

l. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 SEAM AND JOINT SEALING

a. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

1) For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

a) Systems for residential occupancy.

b) Ducts that are located directly in zones they serve.

b. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."

1) For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

a) Systems for residential occupancy.

b) Ducts that are located directly in zones they serve.

3.3 HANGER AND SUPPORT INSTALLATION

a. Attachment of duct supports shall be per DSA approved drawings.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

a. Install ducts with hangers and braces designed to support the duct and to restrain

b. Drilling for and Setting Anchors:

1) Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2) Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3) Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4) Set anchors to manufacturer's recommended torque, using a torque wrench.

5) Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS

a. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

b. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

a. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

a. Perform tests and inspections.

b. Leakage Tests:

1) Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."

2) Test the following systems:

a) Exhaust air.

3) Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4) Test for leaks before insulation application.

5) Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

c. Duct System Cleanliness Tests:

1) Visually inspect duct system to ensure that no visible contaminants are present.

2) Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

d. Duct system will be considered defective if it does not pass tests and inspections.

e. Prepare test and inspection reports.

3.8 DUCT CLEANING

a. Clean new and existing duct system(s) before testing, adjusting, and balancing.

b. Use service openings for entry and inspection.

1) Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.

2) Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3) Remove and reinstall ceiling to gain access during the cleaning process.

c. Particulate Collection and Odor Control:

1) When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2) When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

d. Clean the following components by removing surface contaminants and deposits:

1) Air outlets and inlets (registers, grilles, and diffusers).

2) Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3) Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4) Coils and related components.

5) Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6) Supply-air ducts, dampers, actuators, and turning vanes.

7) Dedicated exhaust and ventilation components and makeup air systems.

e. Mechanical Cleaning Methodology:

1) Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2) Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3) Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4) Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5) Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6) Provide drainage and cleanup for wash-down procedures.

7) Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 DUCT SCHEDULE

a. Fabricate ducts with galvanized sheet steel except as follows:

1) Moist Environment Ducts: Aluminum.

b. Intermediate Reinforcement:

1) Galvanized-Steel Ducts: Galvanized steel.

2) Stainless-Steel Ducts: Galvanized steel.

3) Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

c. Elbow Configuration:

1) Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a) Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b) Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

d. Branch Configuration:

1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a) Velocity 1000 fpm or Lower: 90-degree tap.

b) Velocity 1000 to 1500 fpm: Conical tap.

c) Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 80 00 – HEATING ,VENTILATING AND AIR CONDITIONING EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Air conditioning and air handling equipment including but not limited to:

1. Single Packaged Air Conditioning Units.
2. Split System Air Conditioning Units.
3. Split System Heat Pump Units.
4. Fans.

B. Related Requirements:

1. Division 01: General Requirements.
2. Section 07 6000: Flashing and Sheet Metal.
3. Section 22 1000: Plumbing.
4. Section 23 0500: Common Work Results for HVAC.
5. Section 23 0548: HVAC Sound, Vibration and Seismic Control.
6. Section 23 0900: HVAC Instrumentation and Controls.
7. Section 23 3000: Air Distribution.

1.02 DESIGN REQUIREMENTS

A. Work of this Section is based on HVAC equipment units indicated as Basis of Design in Part 2 of this Section. Products from different HVAC equipment manufacturers listed are never identical, although equivalent in capacity, performance, and quality. In the cases where dimensions, weight, configuration and utility requirements differ from the products used as a basis of design, the Contractor, at no additional cost to the Owner, shall coordinate and submit, for Architect review, revisions to the design.

1.03 SUBMITTALS

A. Provide in accordance with Division 01 and Section 23 0500: Common Work Results for HVAC.

B. For products listed that are not the basis of design, submit the following in addition to above requirements:

1. Title 24 Calculations: Replace HVAC unit values in calculation files provided by the Architect and submit for review.

1.04 QUALITY ASSURANCE

A. Provide submittals in accordance with Section 23 0500: Common Work Results for HVAC.

1.05 PROJECT RECORD DOCUMENTS

A. Provide Owner instructions on equipment operation and maintenance procedures, as indicated in Section 23 0500: Common Work Results for HVAC.

1.06 WARRANTY

A. Compressors shall be provided with manufacturer's five year warranty, replacement only.

B. Manufacturer shall warrant parts, except heat exchangers, for a period of five years.

C. Heat exchangers shall be provided with manufacturer’s ten year warranty, replacement only.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Capacities of air conditioning equipment indicated on Drawings are net capacities actually required. Standard catalog ratings shall be adjusted to actual Project site environmental conditions.

2.02 AIR CONDITIONING UNITS - AC (2 Tons-25 Tons)

A. Manufacturers: Carrier, Trane, York, Lennox, Toshiba, American Standard Heating & Air Conditioning, or equal.

1. Basis of Design: [Toshiba]

B. Furnish packaged air conditioning unit with gas heating for roof top installation. Unit shall be self-contained, completely factory assembled, with complete internal wiring and controls. Unit shall also be provided with a fully piped refrigerant circuit, fully charged with an environmentally friendly refrigerant that is not scheduled for phase out. Unit shall be field configurable for down-flow or horizontal discharge. Cooling and heating capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

C. Quality Assurance:

1. Units shall be CSA certified for outdoor installation.

2. Cooling capacity shall be rated in accordance with current ANSI/AHRI Standard 210/240.

3. Unit shall be UL listed and designed to conform to ANSI/ASHRAE Standard 15 Safety Code for Mechanical Refrigeration and ANSI Z21.47-2016/CSA 2.3-2016 Gas

4. ANSI/NFPA 70: National Electrical Code.

5. Unit cooling efficiency EER/SEER ratings shall comply with CCR, Title 24, Building Energy Efficiency Standards for Residential and Nonresidential Buildings, and shall not be less than ratings indicated on drawings.

6. Unit heating efficiencies AFUE ratings shall comply with current CCR, Title 24, Building Energy Efficiency Standards for Residential and Nonresidential Buildings, and shall not be less than ratings indicated on drawings.

7. Unit shall comply with California Maximum Oxides of Nitrogen (NOX) Emission Regulations and current SCAQMD regulations.

8. The unit roof curbs shall conform to NRCA standards.

9. Insulation and adhesive shall meet NFPA 90A and 90B requirements for flame spread and smoke generation.

10. Unit casing shall be capable of withstanding ASTM B117 500-hour salt spray test.

11. Each unit shall be run tested at factory per ANSI/ASHRAE 37 and provided with a certificate indicating tested pressures, amperages, dates, and inspector.

D. Unit Cabinet:

1. Galvanized steel with baked enamel finish on external surfaces that are exposed to weather.

2. Interior surfaces exposed to conditioned and return air streams shall be insulated with a minimum ½-inch thick, 1 pound density foil-faced cleanable insulation.

3. Cabinet top cover shall be of one piece construction or where seams exist, shall be double hemmed and gasket sealed.

4. Cabinet panels shall be hinged access panels for filter, compressors, evaporator fan, control box and heat section areas. Each panel shall use multiple quarter-turn latches. Each major external hinged access panel shall be permanently attached to rooftop unit. Panels shall also include tiebacks.

5. Return air filters shall be accessible through a hinged access panel and be on a slide-out track using standard size filters.

6. Holes shall be provided in base rails (minimum 16 gage) for rigging shackles and level travel and movement during overhead rigging operations.

7. Unit shall have a factory-installed internally sloped condensate drain pan, providing a minimum ¾-inch-14 NPT connection to prevent standing water from accumulating. Pan shall be fabricated of high impact polycarbonate material, epoxy powder coated steel or stainless steel and shall slide out for cleaning or maintenance. An alternate vertical drain (¾-inch NPT) connection shall also be available. Drain pans shall conform to ASHRAE 62 self-draining provisions.

E. Compressors:

1. Unit shall be furnished with single (If single compressor is used, then it shall be Two Stage type) or multiple fully hermetic scroll compressors with internal vibration isolators.

2. Dual electrically and mechanically independent refrigerant circuits for 7.5 tons and above.

3. Compressors shall be provided with service access valves.

4. Compressor motors shall be cooled by refrigerant passing through motor windings.

5. Compressors shall be provided with line break thermal and current overload protection.

6. Compressors shall be provided with crankcase heaters, internal high-pressure and temperature protection.

7. Compressors on unit rated 90,000 BTU and below shall be of two stage types.

F. Refrigerant circuit components:

1. Thermostatic expansion valve (TXV) with removable power element.

2. Refrigerant strainer.

3. Service gage connections on suction, discharge, and liquid lines.

4. Solid core refrigerant filter driers.

G. Evaporator and Condenser Coils: Standard Evaporator and condenser coils shall be furnished with:

1. Acceptable Condenser Coils:

a. Copper-tube, Aluminum-fin coil, with liquid subcooler. Internally enhanced OD seamless copper tubing mechanically bonded to aluminum fins in combination with a factory applied Corrosion-Resistant Epoxy Coating. Provide Protective Hail Guard.

b. Spine Fin condenser coil shall be continuously wrapped, corrosion resistant aluminum with minimum brazed joints. This coil is 3/8 inch OD seamless aluminum tubing glued to a continuous aluminum fin. Coils are lab tested to withstand 2,000 pounds of pressure per square inch. The outdoor coil provides low airflow resistance and efficient heat transfer. The coil is protected on four sides by louvered panels.

c. Coil shall be air-cooled Micro-Channel Heat Exchanger Technology (MCHX) and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a factory applied Corrosion-Resistant Epoxy Coating. Provide protective Hail Guard.

2. Evaporator coils

a. Aluminum plate fins mechanically bonded to enhanced copper tubes with joints brazed.

b. Tube sheet openings shall be belled to prevent tube wear.

c. Evaporator coil shall be of full-face active design.

d. Dual circuit models shall have face-split type evaporator coil.

H. Evaporator and Condenser Coils shall be furnished with copper plate fins mechanically bonded to enhanced copper tubes with copper tube sheets and brazed joints with a factory applied Corrosion-Resistant Epoxy Coating utilizing dipping process. Provide protective Hail Guard.

I. Fans and Motors:

1. Evaporator fan shall be a dynamically balanced, double width, double inlet, forward curved centrifugal type, fabricated of steel with a corrosion resistant finish that was tested and rated in accordance with AMCA requirements.

2. Evaporator fans shall be direct-driven for the AC Units with the cooling capacity of less than or equal to 48,000 BTU/H, and belt or direct-driven for the AC units with the cooling capacity of greater than 48,000 BTU/H, as indicated on Drawings.

3. Direct drive fans shall be provided with ECM motor.

4. Evaporator blower and motor shall have permanently lubricated, factory-sealed ball bearings and automatic-reset thermal overload protection.

5. Belt drive shall include an adjustable-pitch motor pulley. Belt drive fans shall accommodate from 0.6 inch to 1.6-inch external static pressure without changing drives or motors.

6. Condenser fan shall be a dynamically balanced, propeller type, fabricated of aluminum blades riveted to corrosion resistant steel spiders and direct-driven by a totally enclosed motor. Condenser air shall be discharged vertically. Condenser fan motor shall be high efficiency or ECM type motor and provide cooling operation down to 25 degrees F outdoor temperature with automatic-reset thermal overload protection.

J. Controls, Safeties and Diagnostic Points:

1. Unit Controls: Unit shall be furnished with self-contained, network capable and ready direct digital controls.

a. Controls shall be factory-installed.

b. Controls shall operate with zone control systems.

c. Controls shall furnish built-in diagnostics for thermostat commands for staged heating and cooling, evaporator-fan operation, and economizer operation.

d. Controls shall be furnished with a 5-minute time delay between modes of operation.

e. Control circuit shall be protected by a fuse on 24-V transformer side.

f. Control shall incorporate passive infrared detection for sensing occupancy in space serve.

2. Compressor high temperature, high current, internal overloads, internal thermostat.

a. Compressor reverse rotation protection.

b. Loss-of-charge/low-pressure switch.

c. Freeze-protection thermostat, evaporator coil.

d. High-pressure switch. The lockout protection shall be easily disconnected at control board, if necessary.

e. Internal relief valve.

f. Anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any off cycle.

3. Operating Characteristics:

a. Unit shall be capable of starting and operating at 125 degrees F ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 360 at plus or minus 10 percent voltage.

b. Compressor with standard controls shall be capable of operation down to 25 degrees F ambient outdoor temperature.

K. Filter Section:

1. Provide filter section with factory-installed low-velocity, throwaway 2-inch thick high capacity, MERV 13, or equal, filters of commercially available sizes unless noted otherwise on the drawings.

2. Filter face velocity shall not exceed 300 fpm at nominal airflows.

3. Filter section shall allow installation of standard size air filter.

4. Return air filters shall be accessible through a hinged access panel using standard size filters.

L. 100 Percent Outdoor Air Economizer:

1. Provide 100 percent outdoor air economizers as indicated on drawings.

2. Gear-driven integrated economizers.

3. Integrated integral-modulating type capable of simultaneous economizer and compressor operation.

4. Furnish hardware and controls to provide cooling with outdoor air.

5. Low-leakage dampers not to exceed 3 percent leakage, at one inch wg pressure differential (variable sliding economizer).

6. Barometric relief damper. Damper shall close upon unit shutoff.

7. Differential temperature and enthalpy controller unless indicated otherwise on drawings.

8. Provide units with centrifugal power exhaust controlled by a pressure sensor in space or outdoor air measurement and tracking as indicated on drawings. The controller shall modulate VFD in centrifugal power exhaust to maintain a pressure differential of 0.03 inch of water between indoor and atmospheric pressure. Furnish field wiring to power exhaust and install tubing in space. Provide other accessories as required to comply with UL or ETL requirements.

9. Base Rail: Factory installed on both horizontal and down-flow units.

10. Dampers Using Electronic Actuators:

    a. Manufacturer: Belimo, Honeywell, Invensys, Johnson Controls, or equal.

    b. Size for torque required for damper seal at load conditions.

    c. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.

    d. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to prevent damage to the actuator during a stall condition.

    e. Fail-Safe Operation: Mechanical, spring-return mechanism.

    f. Power Requirements: Maximum of 10 VA at 24 VAC or 8 W at 24 VDC.

    g. Proportional Actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable by use of external computer software. Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload and mechanical travel. Programming shall be through EEPROM without the use of actuator mounted switches.

    h. Actuators shall be listed by ISO 9001, ULC, and CSA C22.2.

M. Demand Controlled Ventilation:

1. Units with 100 percent outdoor air economizers shall be provided with Indoor Air Quality (CO_2) Sensor and Accessory Electronic Expansion Boards.

2. The unit shall have ability to provide demand ventilation indoor-air quality (IAQ) control through economizer when provided with an indoor air quality sensor and accessory expansion board.

3. The IAQ sensor shall be wall mounted unless otherwise indicated on Drawings. The set point shall be adjustable.

4. The IAQ sensor shall be powered through unit. If not, required control transformer shall be provided by manufacturer. Coordinate power requirements and location with Division 26.

5. The IAQ sensor shall provide a 0-10 VDC signal to expansion board.

N. Parts Availability: Submit proof in writing that majority (minimum 80 percent) of the replacements parts are commonly available and not proprietary. Also, submit proof in writing that a local parts sales and service facility exists, where replacement parts will be warehoused in quantity. Guarantee timely availability for parts that are proprietary.

2.03. FAN COIL UNITS AND CONDENSING UNITS

A. Manufacturer: Carrier, Trane, Toshiba, York, Lennox, American Standard Heating & Air Conditioning, or equal.

1. Basis of Design: [Carrier] [Toshiba]

B. FCU and CU: Furnish fan coil unit (FCU) and condensing unit (CU), split type, air-cooled, roof or ground for ducted connections or free blow. Units shall be air-cooled condensing unit/direct expansion fan coil combinations. Condensing unit outdoor section shall be factory assembled with a direct-drive condenser fans with horizontal or vertical air discharge, scroll-type compressor, refrigerant coil, fan motors, pre-wired control panel and a holding charge of a non-ozone depleting refrigerant. Contractor shall provide additional refrigerant for extended lines. Indoor fan coil unit shall be furnished with horizontal discharge and will include evaporator coil, fan and motor, condensate pan with drain, thermal expansion valve, pre-wired control panel and remote thermostat control. Unit shall provide an EER/SEER complying with CCR, Title 24, Building Energy Efficiency Standards for Residential and Nonresidential Buildings. UL listed and rated at AHRI Standard 210/240.

C. Nominal unit cooling, heating capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

D. Condenser coils:

1. Acceptable Condenser Coils:

a. Copper-tube, aluminum-fin coil, with liquid subcooler. Internally enhanced 3/8-inch outside diameter, seamless copper tubing mechanically bonded to aluminum fins with a factory applied Corrosion-Resistant Epoxy Coating. Provide Protective Hail Guard.

b. Spine Fin™ condenser coil shall be continuously wrapped, corrosion resistant aluminum with minimum brazed joints. This coil is 3/8 inch outside diameter seamless aluminum tubing glued to a continuous aluminum fin. Coils are lab tested to withstand 2,000 pounds of pressure per square inch. The outdoor coil provides low airflow resistance and efficient heat transfer. The coil is protected on four sides by louvered panels.

c. Coil shall be air-cooled Micro-Channel heat exchanger technology (MCHX) and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of

aluminum alloys for fins, tubes, and manifolds in combination with a factory applied Corrosion-Resistant Epoxy Coating. Provide Protective Hail Guard.

E. Condenser Coils shall be furnished with copper plate fins mechanically bonded to enhanced copper tubes with copper tube sheets and brazed joints. Coated coils are not acceptable.

F. Evaporator coils:

1. Aluminum plate fins mechanically bonded to enhanced copper tubes with joints brazed.

2. Tube sheet openings shall be belled to prevent tube wear.

3. Evaporator coil shall be of full-face active design. Dual circuit models shall have face-split type evaporator coil.

G. Evaporator Coils at locations within two miles from ocean shall be furnished with copper plate fins mechanically bonded to enhanced copper tubes with copper tube sheets and brazed joints. Coated coils are not acceptable.

H. Condenser Fan and Motors: Condenser fan shall be a dynamically balanced, propeller type, fabricated of aluminum blades riveted to corrosion resistant steel spiders and direct-driven by a totally enclosed motor. Condenser air shall be discharged horizontally or vertically. Condenser fan motors shall be high efficiency or ECM type motor.

I. Cabinets: Fabricated of galvanized steel, bonderized and finished with baked enamel.

J. Compressor shall be serviceable two stage or variable speed type hermetic scroll. Compressor shall be furnished with access valves and shall be installed on rubber isolators to reduce sound vibration. It shall be furnished with high and low-pressure protection. Each horizontal discharge condensing unit shall be furnished with a factory installed suction accumulator. Field installed accumulators are not permitted. It shall be furnished with high and low-pressure protection, brass external vapor supply line service valves, vapor return line service valves with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps, filter drier, pressure relief, liquid line solenoid valves, thermostatic expansion valves, and a holding charge of refrigerant.

K. Controls: Compressor motor assembly shall be protected with high and low-pressure switches, internal overloads, internal thermostat, internal relief valve, and anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any off cycle. Unit shall incorporate an automatic relay for indoor circulating air blower. Control panel shall be pre-wired in unit casing. The control circuit shall incorporate a manual reset safety circuit to render refrigerant system (compressor and outdoor air motor) inoperative should there be a loss of airflow or refrigerant. Units shall also be furnished with automatic condenser-fan motor protection, high condensing temperature protection, compressor motor current and temperature overload protection, high pressure relief, and condenser fan failure protection.

L. Low Ambient Operation: Head pressure control shall be provided for operation at outside air temperature below 45 degrees F.

M. Filters: Filters shall be 2-inch standard size high capacity replaceable media type MERV 8, or equal, installed in an external 2-inch rack filter section and complete with an access door.

N. An in-line filter-drier shall be provided with equipment and shall be installed at Project site.

O. Economizer: Provide on units with capacities equal to, or larger than 4.5 tons nominal capacity, when the Prescriptive Compliance approach is utilized to comply with Energy Efficiency Standards or where necessary to achieve CHPS pre-requisite and/or CHPS building flush-out compliance. Economizer shall be manufacturer's standard; factory furnished and field installed. Economizer control shall maintain a fixed supply air temperature during free cooling operation by providing full modulation of operable outside and return air dampers.

2.04. HEAT PUMP AND FAN COIL UNITS

A. Manufacturer: Carrier, Trane, York, Lennox, American Standard Heating & Air Conditioning, or equal.

1. Basis of Design: [Carrier]

B. HP and matching indoor fan coil unit and condenser unit: Furnish heat pump, split type, air-cooled, roof or ground installation with ducted connections or free blow. Units shall be air-cooled heat pump/direct expansion fan coil combinations. Heat pump outdoor section shall be factory assembled and furnished with direct-drive condenser fans with horizontal or vertical air discharge, scroll type compressor, refrigerant coil, fan motors, pre-wired control panel. Unit shall also be provided with a fully piped refrigerant circuit, fully charged with an environmentally friendly refrigerant that is not scheduled for phase out. Provide additional refrigerant for extended lines. Indoor fan coil unit shall be furnished with horizontal discharge and will include evaporator coil, fan and motor, condensate pan with drain, thermal expansion valve, pre-wired control panel and remote thermostat control. Nominal unit cooling, heating capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

C. Quality Assurance:

1. Cooling capacity rated in accordance with current AHRI Standard 210/240 and 270. Units shall be listed in AHRI.

2. Unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with NEC.

3. Units shall be constructed in accordance with UL standards and shall carry UL label of approval. Units shall have CSA approval.

4. Units shall be listed in CEC directory.

5. Unit cabinet shall be capable of withstanding ASTM B117 500 hour salt spray test.

6. Unit shall provide an EER/SEER/COP complying with CCR, Title 24, Building Energy Efficiency Standards and per the drawings.

D. Evaporator and condenser coils: Evaporator and condenser coils shall be copper with mechanically bonded, smooth aluminum plate fins. Tube joints shall be brazed with copper or silver alloy. Coils shall be pressure-tested at factory. Protective metal guard for inlet and outlet of outdoor coil.

E. Evaporator and Condenser Coils at locations within two miles from ocean shall be furnished with copper plate fins mechanically bonded to enhanced copper tubes with copper tube sheets and brazed joints. Coated coils are not acceptable.

F. Fans:

1. Condenser Fan and Motors: Condenser fan shall be ECM type motor direct driven, propeller type arranged for horizontal or vertical discharge. Condenser fan motors shall be furnished with inherent protection, and shall be permanently lubricated type, resiliently mounted for quiet operation. Each fan shall be furnished with a safety guard.

2. Evaporator fan section shall be furnished with ECM type motor centrifugal, forward curved, double width, double inlet fan or fans installed on a solid shaft. Fan shall be statically and dynamically balanced and shall rotate on permanently lubricated bearings.

G. Unit Cabinets:

1. Cabinets shall be fabricated of galvanized steel, bonderized and finished with baked enamel.

2. Cabinet interior shall be insulated with minimum one inch thick foil face fiberglass.

3. Outdoor unit compartment shall be isolated and have an acoustic lining to assure quiet operation.

H. Compressor: Compressor shall be two stage or variable speed type hermetic scroll.

1. Compressor shall be furnished with access valves and it shall be installed on rubber isolators to reduce sound vibration.

2. Furnish with high and low-pressure protection.

3. Each heat pump shall be furnished with factory installed suction accumulator. Field installed accumulators are not permitted.

4. It shall be furnished with high and low-pressure protection, brass external vapor supply line service valves, vapor return line service valves with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps, filter drier, pressure relief, liquid line solenoid valves, thermostatic expansion valves, and a holding charge of refrigerant.

I. Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, bi-flow filter drier, pressure relief, reversing valve, heating mode metering device, and a holding charge of refrigerant.

J. Controls and Safeties:

1. Compressor motor assembly shall be protected with high and low-pressure switches, internal overloads, internal thermostat, internal relief valve, and anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any off cycle.

2. Control panel shall be pre-wired in unit casing.

3. The control circuit shall incorporate a safety circuit to render refrigerant system (compressor and outdoor air motor) inoperative should there be a loss of airflow or refrigerant.

4. Units shall also be furnished with automatic condenser-fan motor protection, high condensing temperature protection, compressor motor current and temperature overload protection, high pressure relief and condenser fan failure protection.

K. Low Ambient Operation: Head pressure control shall be provided for operation at outside air temperature below 45 degrees F.

L. Safeties:

1. High condensing temperature protection.

2. Compressor motor current and temperature overload protection.

3. High pressure relief.

4. Outdoor fan failure protection.

M. Filters:

1. Filters shall be 2-inch standard size high capacity replaceable media type, MERV 13, or equal, installed in an external 2-inch rack filter section and complete with an access door.

2. An-line filter-drier shall be furnished with equipment and installed at Project site.

N. Economizer: Provide on units with capacities equal to, or larger than 4.5 tons nominal capacity, when the Prescriptive Compliance approach is utilized to comply with Energy Efficiency Standards or where necessary to achieve CHPS pre-requisite and/or CHPS building flush-out compliance. Economizer shall be manufacturer's standard; factory furnished and field installed. Economizer control shall maintain a fixed supply air temperature during free cooling operation by providing full modulation of operable outside and return air dampers.

O. Provide programmable digital thermostat with following features:

1. 7-day time clock.

2. Heat, cool, automatic changeover.

3. Occupied / Unoccupied modes.

4. Dry contact switch for input from an external device such as a central time clock, occupancy sensor, or a telephone activated device.

5. Robertshaw, Honeywell, Johnson Controls, Carrier, Schneider Electric, Viconics, or equal with built-in occupancy sensor. Refer to Section 23 0900 for areas with zone damper controls.

6. Remote sensors. Areas that could be subject to vandalism or accidental impact damage such as Gymnasiums, Auditoriums, Multipurpose Rooms, Corridors and

Lobbies shall be provided with thermostats with remote return air duct or room sensors. Verify remote location of sensors and thermostats with Architect.

P. Demand Control Ventilation:

1. Units of 6.25 nominal tons and higher capacity shall be provided with Indoor Air Quality (CO2) Sensor and Accessory Electronic Expansion Boards.

2. The unit shall have ability to provide demand ventilation indoor-air quality (IAQ) control through economizer when provided with an indoor air quality sensor and accessory expansion board.

3. The IAQ sensor shall be duct mounted in return air main duct unless otherwise indicated on Drawings. The set point shall be adjustable.

4. The IAQ sensor shall be powered through unit. If not, required control transformer shall be provided by manufacturer. Coordinate power requirements and location with Division 26.

5. The IAQ sensor shall provide a 4 to 20 mA signal to expansion board.

Q. Start-up: Factory test each unit before shipment to Project site. Performance test shall include full refrigeration start-up, fan and controls start-up. Each unit shall be provided with its own report with its own serial number. Non-tested units are not permitted to be delivered to Project site. Provide full start-up of units to include full refrigeration and provide a written report.

R. Parts Availability: Submit proof in writing that majority (minimum 80 percent) of replacements parts are commonly available and not proprietary. Also, submit proof in writing that a local parts sales and service facility exists, where replacement parts will be warehoused in quantity. Guarantee timely availability for parts that are proprietary.

2.05 UNDER CEILING INDOOR FAN COIL UNIT

A. System Description: Indoor, under ceiling mounted, direct-expansion indoor units are matched with a heat pump or a heat recovery VRF (variable refrigerant flow) outdoor unit.

B. Quality Assurance: Unit shall be ETL (Engineering Testing Laboratory) listed and certified to UL 1994 9th edition standard.

C. Delivery, Storage, and Handling: Units shall be stored and handled per unit manufacturer's recommendations.

D. General:

i. Indoor, direct-expansion, low profile ceiling fan coil. Unit shall be complete with a coil, fan driven by DC inverter motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. The unit shall be furnished with hanging plate.

E. Fans:

i. Fans shall be centrifugal direct-drive blower type with air intakes on the sides of the blower housings and discharge at the front of the blower housings. Automatic, motor-driven vertical air sweep shall be provided standard.

F. Coil:

i. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed left drain connection for hose attachment to remove condensate.

G. Motors:

i. Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

H. Controls:

i. The system shall be microprocessor-controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.

ii. Any of the following user interface accessories shall be compatible with the unit:

1. Wireless Remote Controller: Wireless remote controller kit shall include a hand held device and a receiver not integral to the unit. The receiver shall be field installed on the wall or on the unit.

2. Wired Remote Controller: Wired remote controller shall communicate over two-core shielded wire up to 1640 ft. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when two remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes.

3. Central Controller (Smart Manager): Central controller shall communicate over two-core shielded wire up to 6500 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 128 indoor units individually with capability to program maximum of 10 setups for each day. It shall be able to create 2 indoor unit line-ups with 64 units on each line. It shall provide master, weekly, four special day and monthly scheduling feature. During schedule operation, user can set the power status (ON/OFF), operation mode, temperature setup, and remote control operation, restricted / allowed, return back and ventilation operation. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

4. Central Controller (Touch Screen): Central controller shall communicate over two-core shielded wire up to 1600 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 512 indoor units individually with capability to

program maximum of 20 setups for each day. It shall provide master, weekly, five special day and monthly scheduling feature. In addition, an optional digital I/O interface shall provide alarm, fire and locking signals. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

5. Building Management Systems: The system shall be able to be controlled by BACnet* or LonWorks† protocols either directly or through an external gateway.

   BACnet and LonWorks shall be able to control:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation

   BACnet and LonWorks shall be able to monitor:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation
   g. room temperature
   h. error status
   i. error code

6. The unit shall have the following functions as a minimum:

   a. Selectable automatic restart. After power failure the system will restart at the same operating conditions as before the failure.
   b. Temperature-sensing controls shall sense return air temperature at the unit or at the remote control
   c. Indoor coil freeze protection in both cooling and heating (reversing valve failure) modes.
   d. Automatic air sweep control to provide multiple operating modes of the air sweep louvers.
   e. Dehumidification mode shall provide increased latent removal through total system modulation.
   f. Fan-only operation to provide room air circulation when no cooling is required.

g. Fan speed control shall be user-selectable: high, medium, low, or microprocessor (Auto) determined based on the differential between the room temperature and the set point during all modes of operations.

h. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature in heating.

i. Cold blow prevention in heating.

j. Adjustable compensation for air stratification in heating.

I. Filters:

i. Unit shall have factory-supplied resin net (cleanable) type filters. The return air filter material shall have the following characteristics:

1. Odorless

2. Temperature resistant to 185 F (85 C)

3. Humidity resistant up to 95% RH

J. Electrical Requirements:

i. Indoor units are 208/230-1-60 (V-Ph-Hz)

K. Special Features (Accessories):

i. Condensate Pump, Elbow Kit and Auxiliary OA Flange

2.06 MEDIUM STATIC DUCT INDOOR UNIT

A. System Description: Indoor, direct-expansion medium static duct indoor units are matched with a heat pump or a heat recovery VRF (variable refrigerant flow) outdoor unit.

B. Quality Assurance: Unit shall be ETL (Engineering Testing Laboratory) listed and certified to UL 1994 9th edition standard.

C. Delivery, Storage, and Handling: Units shall be stored and handled per unit manufacturer's recommendations.

D. General:

i. Indoor, direct-expansion ducted fan coil. Unit shall be complete with a coil, fan driven by DC inverter motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, integral temperature sensing, condensate pump drain-pump with a lift capability of 24.3 in. and hanging brackets.

E. Unit Cabinet:

i. Cabinet shall be constructed of zinc-coated steel. The unit shall be capable of being configured for either bottom or rear return. The cabinet shall have a knockout for fresh air intake.

F. Fans:

i. The fan shall be of the multi-blade type with its performance designed to match the coil performance. The fan shall be statically and dynamically balanced to ensure low noise and vibration and capable of up to 0.8 in. wg external static pressure.

G. Coil:

i. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drain pan under the coil shall have a factory-installed condensate lift mechanism and drain connection for hose attachment to remove condensate.

H. Motors:

i. Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

I. Controls:

i. The system shall be microprocessor-controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.

ii. Any of the following user interface accessories shall be compatible with the unit:

1. Wireless Remote Controller: Wireless remote controller kit shall include a hand held device and a receiver not integral to the unit. The receiver shall be field installed on the wall or on the unit.

2. Wired Remote Controller: Wired remote controller shall communicate over two-core shielded wire up to 1640 ft. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when two remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes.

3. Central Controller (Smart Manager): Central controller shall communicate over two-core shielded wire up to 6500 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 128 indoor units individually with capability to program maximum of 10 setups for each day. It shall be able to create 2 indoor unit line-ups with 64 units on each line. It shall provide master, weekly, four special day and monthly scheduling feature. During schedule operation, user can set the power status (ON/OFF), operation mode, temperature setup, and remote control operation, restricted / allowed, return back and ventilation operation. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

4. Central Controller (Touch Screen): Central controller shall communicate over two-core shielded wire up to 1600 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 512 indoor units individually with capability to program maximum of 20 setups for each day. It shall provide master, weekly, five special day and monthly scheduling feature. In addition, an optional digital I/O interface shall provide alarm, fire and locking signals. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

5. Building Management Systems: The system shall be able to be controlled by BACnet* or LonWorks† protocols either directly or through an external gateway.

   BACnet and LonWorks shall be able to control:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation

   BACnet and LonWorks shall be able to monitor:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation
   g. room temperature
   h. error status
   i. error code

6. The unit shall have the following functions as a minimum:

   a. Selectable automatic restart. After power failure the system will restart at the same operating conditions as before the failure.
   b. Temperature-sensing controls shall sense return air temperature at the unit or at the remote control
   c. Indoor coil freeze protection in both cooling and heating (reversing valve failure) modes.
   d. Dehumidification mode shall provide increased latent removal through total system modulation.

e. Fan-only operation to provide room air circulation when no cooling is required.

f. Fan speed control shall be user-selectable: high, medium, low, or microprocessor (Auto) determined based on the differential between the room temperature and the set point during all modes of operations.

g. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature in heating.

h. Cold blow prevention in heating.

i. Adjustable compensation for air stratification in heating.

J. Filters:

i. The cabinet shall be supplied with link screen filter and filter rack.

K. Electrical Requirements:

i. Indoor units are 208/230-1-60 (V-Ph-Hz)

L. Special Features (Accessories):

i. Zoning Duct & Auxiliary OA Flange

2.07 4-WAY CASSETTE FAN COIL UNIT

A. Indoor, in-ceiling mounted, direct-expansion 4-way cassette indoor units are matched with a heat pump or a heat recovery VRF (variable refrigerant flow) outdoor unit.

B. Quality Assurance: Unit shall be ETL (Engineering Testing Laboratory) listed and certified to UL 1994 9th edition standard.

C. Delivery, Storage, and Handling: Units shall be stored and handled per unit manufacturer's recommendations.

D. General:

i. Indoor, direct-expansion, low profile (10.1 in.) in-ceiling fan coil. Unit shall be complete with a coil, fan driven by DC inverter-motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, integral temperature sensing, condensate pump with a lift capability of 26 in., and hanging brackets.

E. Unit Cabinet:

i. Cabinet shall be constructed of zinc-coated steel. Fully insulated discharge and inlet grilles shall be attractively styled, high-impact non- metallic material. The inlet grille shall have hinges and can be opened to obtain access to the cleanable filters, indoor fan motor and control box.

F. Fans:

i. Fan shall be centrifugal direct-drive blower type with air intake in the center of the unit and discharge at the perimeter. Automatic, motor-driven vertical air sweep shall be provided standard. Automatic motor-driven louvers shall be provided standard and shall be adjustable for 2, 3 or 4-way discharge.

ii. Air sweep operation shall provide three user selectable modes.

G. Coil:

i. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed condensate pump and drain connection for hose attachment to remove condensate. A replaceable element in the condensate disposal system provides antibacterial protection.

H. Motors:

i. Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

I. Controls:

i. The system shall be microprocessor-controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.

ii. Any of the following user interface accessories shall be compatible with the unit:

1. Wireless Remote Controller: Wireless remote controller kit shall include a hand held device and a receiver not integral to the unit. The receiver shall be field installed on the wall or on the unit.

2. Wired Remote Controller: Wired remote controller shall communicate over two-core shielded wire up to 1640 ft. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when two remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes.

3. Central Controller (Smart Manager): Central controller shall communicate over two-core shielded wire up to 6500 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 128 indoor units individually with capability to program maximum of 10 setups for each day. It shall be able to create 2 indoor unit line-ups with 64 units on each line. It shall provide master, weekly, four special day and monthly scheduling feature. During schedule operation, user can set the power status (ON/OFF), operation mode, temperature setup, and remote control operation, restricted / allowed, return back and ventilation operation. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

4. Central Controller (Touch Screen): Central controller shall communicate over two-core shielded wire up to 1600 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 512 indoor units individually with capability to program maximum of 20 setups for each day. It shall provide master, weekly, five special day and monthly scheduling feature. In addition, an optional digital I/O interface shall provide alarm, fire and locking signals. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

5. Building Management Systems: The system shall be able to be controlled by BACnet* or LonWorks† protocols either directly or through an external gateway.

   BACnet and LonWorks shall be able to control:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation

   BACnet and LonWorks shall be able to monitor:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation
   g. room temperature
   h. error status
   i. error code

6. The unit shall have the following functions as a minimum:

   a. Selectable automatic restart. After power failure the system will restart at the same operating conditions as before the failure.
   b. Temperature-sensing controls shall sense return air temperature at the unit or at the remote control
   c. Indoor coil freeze protection in both cooling and heating (reversing valve failure) modes.
   d. Dehumidification mode shall provide increased latent removal though total system modulation.

e. Dehumidification mode shall provide increased latent removal through total system modulation.

f. Fan-only operation to provide room air circulation when no cooling is required.

g. Fan speed control shall be user-selectable: high, medium, low, or microprocessor (Auto) determined based on the differential between the room temperature and the set point during all modes of operations.

h. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature in heating.

i. Cold blow prevention in heating.

j. Adjustable compensation for air stratification in heating.

J. Filters:

i. Unit shall have factory-supplied resin net (cleanable) type filters. The return air filter material shall have the following characteristics:

1. Odorless

2. Temperature resistant to 185 F

3. Humidity resistant up to 95% RH

K. Electrical Requirements:

i. Indoor units are 208/230-1-60 (V-Ph-Hz)

L. Special Features (Accessories):

i. Outdoor air accessories shall provide either conditioned or unconditioned fresh air

ii. Air-discharge direction kit

iii. Ceiling Panel (grille)

iv. Spacer for filter accommodation

2.08 COMPACT 4-WAY CASSETTE FAN COIL UNIT

A. Indoor, in-ceiling mounted, direct-expansion 4-way cassette indoor units are matched with a heat pump or a heat recovery VRF (variable refrigerant flow) outdoor unit.

B. Quality Assurance: Unit shall be ETL (Engineering Testing Laboratory) listed and certified to UL 1994 9th edition standard.

C. Delivery, Storage, and Handling: Units shall be stored and handled per unit manufacturer's recommendations.

D. General:

i. Indoor, direct-expansion, low profile (10.6 in.), compact (22.6 x 22.6 in.) in-ceiling fan coil. Unit shall be complete with a coil, fan driven by DC inverter motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, integral temperature sensing, condensate pump with a lift capability of 24.7 in., and hanging brackets.

E. Unit Cabinet:

i. Cabinet shall be constructed of zinc-coated steel. Fully insulated discharge and inlet grilles shall be attractively styled, high-impact non- metallic material. The inlet grille shall have hinges and can be opened to obtain access to the cleanable filters, indoor fan motor and control box.

F. Fans:

i. Fan shall be centrifugal direct-drive blower type with air intake in the center of the unit and discharge at the perimeter. Automatic, motor-driven vertical air sweep shall be provided standard. Automatic motor-driven louvers shall be provided standard and shall be adjustable for 2, 3 or 4-way discharge.

ii. Air sweep operation shall provide three user selectable modes.

G. Coil:

i. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed condensate pump and drain connection for hose attachment to remove condensate. A replaceable element in the condensate disposal system provides antibacterial protection.

H. Motors:

i. Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.

I. Controls:

i. The system shall be microprocessor-controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.

ii. Any of the following user interface accessories shall be compatible with the unit:

1. Wireless Remote Controller: Wireless remote controller kit shall include a hand held device and a receiver not integral to the unit. The receiver shall be field installed on the wall or on the unit.

2. Wired Remote Controller (Lite Vision Plus): Wired remote controller shall communicate over two-core shielded wire up to 1640 ft. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when two remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or

through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes.

3. Central Controller (Smart Manager): Central controller shall communicate over two-core shielded wire up to 6500 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 128 indoor units individually with capability to program maximum of 10 setups for each day. It shall be able to create 2 indoor unit line-ups with 64 units on each line. It shall provide master, weekly, four special day and monthly scheduling feature. During schedule operation, user can set the power status (ON/OFF), operation mode, temperature setup, and remote control operation, restricted / allowed, return back and ventilation operation. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

4. Central Controller (Touch Screen): Central controller shall communicate over two-core shielded wire up to 1600 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 512 indoor units individually with capability to program maximum of 20 setups for each day. It shall provide master, weekly, five special day and monthly scheduling feature. In addition, an optional digital I/O interface shall provide alarm, fire and locking signals. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

5. Building Management Systems: The system shall be able to be controlled by BACnet* or LonWorks† protocols either directly or through an external gateway.

   BACnet and LonWorks shall be able to control:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation

   BACnet and LonWorks shall be able to monitor:

   a. ON / OFF
   b. operation mode
   c. fan speed
   d. louver
   e. set temperature
   f. permit / prohibit local operation

g. room temperature

h. error status

i. error code

6. The unit shall have the following functions as a minimum:

a. Selectable automatic restart. After power failure the system will restart at the same operating conditions as before the failure.

b. Temperature-sensing controls shall sense return air temperature at the unit or at the remote control

c. Indoor coil freeze protection in both cooling and heating (reversing valve failure) modes.

d. Dehumidification mode shall provide increased latent removal through total system modulation.

e. Fan-only operation to provide room air circulation when no cooling is required.

f. Fan speed control shall be user-selectable: high, medium, low, or microprocessor (Auto) determined based on the differential between the room temperature and the set point during all modes of operations.

g. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature in heating.

h. Cold blow prevention in heating.

i. Adjustable compensation for air stratification in heating.

J. Filters:

i. Unit shall have factory-supplied resin net (cleanable) type filters. The return air filter material shall have the following characteristics:

1. Odorless

2. Temperature resistant to 185 F

3. Humidity resistant up to 95% RH

K. Electrical Requirements:

i. Indoor units are 208/230-1-60 (V-Ph-Hz)

L. Special Features (Accessories):

i. Ceiling panel (grille)

2.09 ROOFTOP INDOOR UNIT

A. General: Indoor, direct-expansion, rooftop fan coils. Unit shall be complete with a coil, vane axial fan driven by ECM (electronically-commutated motor), PMV (pulse modulating valve),

piping connectors, electrical controls, microprocessor control system, integral temperature sensing, and roof curb designed to conform to NRCA standards.

B. Unit Cabinet: Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.

C. Fans: The fan shall be of the multi-blade type with performance designed to match the coil performance. The fan shall be statically and dynamically balanced to ensure low noise and vibration and capable of up to 1.2 in. wg external static pressure.

D. Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed drain connection to remove condensate.

E. Motors:

i. Shall be multi-speed ECM.

ii. Shall use permanently lubricated bearings.

iii. Shall be electronically protected.

F. Controls: The system shall be microprocessor controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.

Any of the following user interface accessories shall be compatible with the unit.

i. Wire Remote Controller: Wired remote controller shall communicate over two-core shielded wire up to 1640 ft. It shall be capable of controlling groups of up to 8 indoor units. It shall be able to operate as a primary or secondary controller when two remote controllers are connected to a single indoor unit or group. The system shall be able to be configured so that the return air (TA) can be sensed at the unit, at the remote controller or through a remote sensor. The local controller shall minimally be able to control On-OFF, set point, mode, and be able to display system generated error codes.

ii. Central Controller (Smart Manager): Central controller shall communicate over two-core shielded wire up to 6500 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 128 indoor units individually with capability to program maximum of 10 setups for each day. It shall be able to create 2 indoor unit line-ups with 64 units on each line. It shall provide master, weekly, four special day and monthly scheduling feature. During schedule operation, user can set the power status (ON/OFF), operation mode, temperature setup, and remote control operation, restricted / allowed, return back and ventilation operation. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

iii. Central Controller (Touch Screen): Central controller shall communicate over two-core shielded wire up to 1600 ft and use existing indoor – outdoor communication protocol to communicate. A single central controller shall be capable of controlling up to 512 indoor units individually with capability to program maximum of 20 setups for each

day. It shall provide master, weekly, five special day and monthly scheduling feature. In addition, an optional digital I/O interface shall provide alarm, fire and locking signals. It shall provide a web interface for remote monitoring, control, and scheduling. It shall be capable of monitoring energy consumption for each tenant and generate monthly billing reports.

iv. Building Management Systems

The systems shall be able to be controlled by BACnet or LonWorks protocols either directly or through an external gateway.

BACnet and LonWorks shall be able to control:

1. ON / OFF
2. operation mode
3. fan speed
4. louver
5. set temperature
6. permit / prohibit local operation

BACnet and LonWorks shall be able to monitor:

1. ON / OFF
2. operation mode
3. fan speed
4. louver
5. set temperature
6. permit / prohibit local operation
7. room temperature
8. error status
9. error code

v. The unit shall have the following functions as a minimum:

1. Selectable automatic restart. After power failure the system will restart at the same operating conditions as before the failure.
2. Temperature-sensing controls shall sense return air temperature at the unit or at the remote control

3. Indoor coil freeze protection in both cooling and heating (reversing valve failure) modes.

4. Dehumidification mode shall provide increased latent removal through total system modulation.

5. Fan-only operation to provide room air circulation when no cooling is required.

6. Fan speed control shall be user set to one of three speeds by local or central controller.

7. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature in heating.

8. Cold blow prevention in heating.

9. Adjustable compensation for air stratification in heating.

G. Filters:

i. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.

ii. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filter.

iii. Filters shall be standard, commercially available sizes.

iv. Only one size filter per unit is allowed.

H. Electrical Requirements:

i. Indoor units are available for both 208/230-1-60 & 460-3-60 (V-Ph-Hz).

ii. Factory supplied, field installed Single Point Electric Heater kits are available for both 208/230-3-60 & 460-3-60 (V-Ph-Hz). Single Point Electric Heater kit can also send 1-phase power internally to power the unit's fan and controls; no separate 1-phase power is required with kit.

I. Special Features, Options and Accessories:

i. Standard Leak Economizers:

1. Available as field-installed accessory (vertical or horizontal) on all models.

2. Standard leak economizers are available with EconoMi$er X Controls:

a. For use with field-installed accessory (vertical or horizontal) on units with standard leak economizers.

b. Meets California's Title 24 section 120.2 mandatory requirements for economizer Fault Detection and Diagnosis (FDD).

c. Economizer controller shall be Honeywell W7220 JADE that provides:

i. 2-line LCD interface screen for setup, configuration and troubleshooting.

ii. On-board FDD detects and alerts when economizer is not operating properly.

iii. Sensor failure loss of communication identification.

iv. Automatic sensor detection.

v. Capabilities for use with multi-speed indoor fan units.

d. Compressor lockout temperature on W7220 is adjustable from -45 to 80°F, set at a factory default of 32°F.

e. Shall be designed to spring return close outside air damper during loss of power.

f. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

3. Utilizes dry bulb outside air sensor (factory-installed).

4. Integrated, gear driven opposed blade design type capable of simultaneous economizer and compressor operation.

5. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

6. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

7. Shall be capable of introducing up to 100% outdoor air.

8. Economizer's barometric relief dampers shall be sized to allow up to 100% relief (actual results will be based on specific job conditions).

ii. Electric Heat:

1. Available as field-installed accessory on all models.

2. Shall include Single Point Box kit for field power termination location plus an enclosure for heater fuses when required by code.

3. Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.

4. Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermal limit controls, magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.

2.10 ROOF MOUNTED POWER EXHAUST VENTILATORS

A. RMEV-1

1. Manufacturer:

CARNES	GREENHECK	LOREN COOK	PENNBARRY	TWIN CITY & BLOWER	OR EQUAL
VEBK Series	GB Series	ACEB	Domex-Belt Drive	BCRD	

2. Spun aluminum, roof mounted, belt driven, downblast centrifugal exhaust ventilator, with components as indicated and specified. Sizes, performances, and accessories shall be as indicated on equipment schedules on Drawings. Provide required accessories for proper operation and balancing of fans in accordance with design intent and sequence of operation.

3. Certification: Fan shall be listed by Underwriters Laboratories Inc (UL 705). Fan shall bear AMCA Certified Ratings Seals for Fan Sound and Air Performance.

4. Housing: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 18 gage Aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. A two piece top cap shall have stainless steel, or galvanized quick release latches to provide access into motor compartment without use of tools, or screws. An integral conduit chase shall be provided through curb cap and into motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 16 gage steel power assembly, isolated from unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting. Unit shall bear an engraved aluminum nameplate.

5. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204, Balance Quality and Vibration Levels for Fans.

6. Motor: Motor shall be heavy-duty ECM type with permanently lubricated sealed ball bearings and furnished at specified voltage, phase, and enclosure.

7. Bearing: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

8. Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision-machined cast iron type, or heavy gauge galvanized steel, keyed and securely attached to wheel and motor shafts. Drives shall be sized for 150 percent of installed motor horsepower. The variable pitch motor drive must be factory set to specified fan RPM.

2.11 FILTERS

A. Air filters shall be of pleated, high capacity, disposable type of efficiencies indicated on drawings. Each filter shall consist of a non-woven cotton fabric media, media support grid, and enclosing frame. Filter shall be UL 900 listed, Class 2.

B. Filter media shall provide an average efficiency as specified on drawings per ASHRAE Standard 52.2.

C. Initial resistance of air filters shall not exceed following limits for each efficiency level at face velocities indicated. Lower resistance requirements, if indicated on drawings shall have precedence.

30 percent (MERV 8) 0.27 inch water gage at 500 feet per minute
75 percent (MERV 11) 0.28 inch water gage at 500 feet per minute
85 percent (MERV 13) 0.30 inch water gage at 500 feet per minute

D. Use standard size Filter Medias only.

E. Media support shall be a welded wire grid or a rigid frame with an effective open area of not less than 96 percent.

1. Media support shall be bonded to filter media to eliminate possibility of media oscillation and media pull-away.

2. Media support grid shall be formed in such a manner that it effectively forms a radial pleat design, providing total use of filter media.

F. Enclosing frame shall be bonded to air entering and air exit side of each pleat, to ensure pleat stability. Inside periphery of enclosing frame shall be bonded to filter pack, thus eliminating possibility of air bypass.

G. Holding frames shall be factory fabricated of 16 gage galvanized steel, or equivalent and shall be furnished with gaskets and spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without use of tools.

H. Manufacturers: Camfil Farr, Koch, or AAF.

PART 3 – EXECUTION

3.01 GENERAL

A. Examine areas under which Work of this Section will be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 EQUIPMENT FOUNDATIONS

A. Provide foundations (housekeeping pads, level platforms or curbs) for mechanical equipment whether indicated on drawings or not. Equipment foundations shall be of sufficient size and weight, and of proper design to preclude shifting of equipment under operating conditions, or under abnormal conditions imposed upon equipment.

B. Provide foundations (housekeeping pads, level platforms or curbs) for mechanical equipment whether indicated on drawings or not. Foundations shall meet requirements of equipment manufacturer and, when required by Architect, obtain from equipment manufacturer, approval of foundation design and construction, for equipment to be installed. Equipment vibration shall be maintained within design limits, and shall be dampened and isolated. Isolators shall be bolted to a structural member so as to be readily removable.

3.03 EQUIPMENT DESIGN AND INSTALLATION

A. Uniformity: Unless otherwise specified, equipment of same type or classification shall be product of same manufacturer.

B. Application: Only provide equipment as reviewed by Architect.

C. Equipment Installation: Equipment installation shall be in strict accordance with these Specifications, and installation instructions of manufacturers. Equipment installed on concrete foundations shall be grouted before piping is installed. Piping shall be installed in such a manner as not to place a strain on equipment. Flanged joints shall be adequately extended before installation. Piping shall be graded, anchored, guided and supported, without low pockets.

1. Install equipment in a neat and skillful manner, properly aligned, leveled, and adjusted for satisfactory operation.

2. Install so connecting and disconnecting of piping and accessories can be readily accomplished, parts are readily accessible for inspection, service and repair. Space shall be provided to readily remove filters, coils, compressors and fan wheels. Access doors shall be hinged with cam lock door handles.

3. Provide flexible connections for duct, pipe and conduit connections at moving equipment.

3.04 ROOF-TOP EQUIPMENT MOUNTING

A. Horizontal Flow Packaged Units: Install unit on platform or prefabricated mounting frame or curb secured directly to roof designed to suit roof conditions and requirements of provided unit. Submit Shop Drawings for review by Architect.

3.05 NOISE AND VIBRATION

A. Operation of Equipment: Mechanical equipment and piping systems shall operate without exceeding specified noise and/or vibration levels.

B. Corrective Measures: If specified noise and/or vibration levels are exceeded, provide necessary changes to reduce noise and/or vibration levels to within specified levels.

3.06 FIELD TESTS AND INSPECTION

A. General: Perform field inspections, field tests, and trial operations as specified in Section 23 0500: Common Work Results for HVAC. Provide labor, equipment and incidentals required for testing. The Project Inspector will witness field tests and trial operations as specified in Section 23 0500: Common Work Results for HVAC.

B. Equipment and Material: Equipment and material certified as being successfully tested by manufacturer, in accordance with referenced Specifications and standards, will not require re-testing before installation. Equipment and materials not tested at place of manufacture will be tested before or after installation, as applicable or necessary, to determine compliance with reference Specifications and standards.

C. Start-Up and Operational Test: System shall be started up and initially operated with components operating. During this test, various strainers or filters shall be periodically cleaned until no further accumulation of foreign material occurs. Adjust safety and automatic control instruments as required to provide proper operation and control sequence. Refer to Section 23 0500: Common Work Results for HVAC.

D. Extent of Field Tests: After installation and before completion, Work of this Section shall be subjected to required field tests, including those specified here and in Section 23 0500: Common Work Results for HVAC.

E. Operation and Maintenance Data: Provide required operation and maintenance data as specified in Section 23 0500: Common Work Results for HVAC.

3.07 REFRIGERANT PIPING

A. Unless otherwise indicated, main liquid and suction lines from condensing unit to evaporator coil shall be of sizes specified by manufacturer.

B. Refrigeration piping shall be refrigeration grade copper tubing, type L hard-drawn. In instances where refrigeration lines are installed in an inaccessible location and must be snaked through conduit or a trench, that portion of tubing required to complete connections through conduit or trench may be soft drawn. Maintain entire system clean and dry during installation. Pipe shall be sealed until installed.

C. Refrigeration piping, both hard and soft-drawn, shall be straight and free from kinks, restrictions and horizontal runs shall be sloped towards compressor one inch to 10 feet wherever possible. Vapor line oil traps shall be installed on bottom of vertical risers and inverted oil trap shall be installed on top of vertical risers.

D. Joints shall be installed with Sil-Fos 15, Silvaloy 15, or equal.

E. Flare nuts required on suction lines shall be of short forged or frost-proof type. Other fittings shall be standard sweat-soldered type. Ells and return bends shall be long radius type. Install leak lock material.

F. Refrigeration Piping: Joints shall be silver brazed and leak tested. Field fabricated lines shall be thoroughly flushed and cleaned before connection. Bleed nitrogen through lines during silver brazing, and cap and seal lines when not completed and connected to equipment.

G. Sleeve penetrations of floors, walls and ceiling to allow for free motion of piping. Provide 24 gage galvanized iron pipe and chrome-plated escutcheon plates. Pack annular space between pipe and sleeve with incombustible material such as fiberglass and seal each end with mastic to provide a waterproof seal.

H. Install insulated couplings at points of connection between dissimilar metals for cathodic protection. Insulate copper tubing from ferrous materials and hangers with 2-inch thickness of 3-inch wide strip, 10 mil polyvinyl tape wrapped around pipe.

I. Support piping by iron hangers and supports. Hydra-Zorb cushion clamps, LSP Products Group Acousto Clamp, or equal, on non-insulated piping, and Klo-Shure coupling clamp on insulated piping, or equal.

J. Provide saddles to protect pipe insulation.

K. Provide connections of copper, copper plated steel, steel, and brass pipe and tubing with Harris Products Group Safety-Silv 56, Lucas-Milhoupt, Inc., or equal, complying with ANSI/AWS A5.8 and NSF 51.

L. Insulate refrigerant suction lines.

M. On split heat pump systems, insulate both vapor and liquid lines. For insulation materials, refer to Section 23 0700: HVAC Insulation.

3.08 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

3.09 PROTECTION

A. Protect Work of this Section until Substantial Completion.

END OF SECTION

DIVISION 26
ELECTRICAL

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.

B. Related Requirements:

1. Division 01 – General Requirements.
2. Section 03 30 00 – Cast-in-Place Concrete.
3. Section 09 90 00 – Painting and Coating.
4. Division 14 – Conveying Equipment.
5. Division 23 – HVAC.
6. Division 26 – Electrical.
7. Division 27 – Communications.
8. Division 28 – Electronic Safety and Security.
9. Division 31 – Earthwork.
10. Division 33 – Site Improvements.

C. Related Industry Standards: The most current version of the following industry standards.

1. ASTM D 709 – Laminated Thermosetting materials.
2. ANSI/NEMA FB-1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
3. ANSI/NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
4. California Electrical Code (CEC).
5. IEEE C57.12.28 – Standard for Pad-Mounted equipment Enclosure Integrity.
6. IEEE 1584 – Performing Arc-Flash Hazard Calculations.
7. UL/ANSI 1 – Standard for Flexible Metal Conduit.
8. UL/ANSI 1242 – Standard for Electrical Intermediate Metal Conduit.
9. UL/ANSI 506 – Standard for Specialty Transformers.

10. UL/ANSI 6 – Electrical Rigid Metal Conduit-Steel.
11. UL/ANSI 6A – Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.
12. UL 797 – Electrical Metallic Tubing-Steel.
13. UL/ANSI 870 – Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
14. UL/ANSI 891 – Standard for Safety Switchboards.

1.02 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:

1. Work shall be performed by CONTRACTOR'S personnel possessing the skills and experience obtained in performing work of similar scope and complexity.
2. Refer to related division(s) specifications for other requirements.

B. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic, and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
2. Verify final locations for rough-in with field measurements and with the requirements of the equipment to be connected.
3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduits. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.
4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity; CONTRACTOR shall coordinate in the field prior to rough-in work.
6. Coordinate electrical equipment and materials installation with building components and the Work of other trades.
7. Equipment disconnects shall be readily accessible and free of obstructions.
8. When extending or intercepting existing electrical facilities, CONTRACTOR shall Coordinate and verify existing conditions.

C. Terminology:

1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.

3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

E. Structural Considerations for Conduit Routing:

1. CONTRACTOR shall provide DSA approved calculations and drawings as necessary for any construction and/or alterations requiring conduits to pass through or interfere with any structural members, or where notching, boring or cutting of the structure is necessary, or where special openings through walls, floors, footings, or other buildings elements, or where notches and bored holes in wood or steel are required. All work shall conform to CBC, Part 2, Title 24 requirements.

2. Concrete encasement for underground conduits that abuts a foundation wall or underground structure shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.

F. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:

a. Work shall include furnishing and installing wiring enclosures and complete connections of electrically operated equipment, appliances and electrical control devices, which are specified to be furnished and installed in this or other sections of the Specifications. Wiring enclosures shall be concealed except where exposed work is indicated on the drawings.

b. Provide all connections necessary for installation of equipment. Equipment shall be tested for proper operation, including proper rotation of motorized equipment. If outlets are of incorrect electrical characteristics, or any specified equipment fails to operate properly, CONTRACTOR shall repair and/or replace the outlet and/or equipment.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as "Not In Contract" (NIC), "furnished by others," or "furnished by the OWNER," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and

adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 23. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Power Distribution System Reports: For fault current, coordination and Arc-Flash system report requirements refer to applicable electrical distribution equipment sections. for specific requirements.

H. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

I. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped, and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

J. WARRANTIES

1. Provide one-year warranty on all material and labor performed, unless noted otherwise in specific sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Advise the Inspector before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. CONTRACTOR to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

3.02 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.03 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work or surfaces damaged as a result of the work performed under this contract.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose off the Project site.

B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative (OAR).

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 0513 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Boxes, enclosures, keys and locks.
2. Receptacles and switches.
3. Identifications and signs.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 26 – Electrical.
3. Division 27 – Communications.
4. Division 28 - Electronic Safety and Security.

PART 2 - PRODUCTS

2.01 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:

1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.
2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.
3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated, or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.
4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.
5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2 1/8-inch deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with two ears drilled 2 23/32 inches center to center.

6. For local device outlets provide 4-inch square 2 1/8-inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than two switches.

7. For TV outlets, and horns and strobes provide manufacturer's supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.

8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.

9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, single-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Raco, Appleton, Cooper, Bowers, or equal.

10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.

11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.

3. Covers shall be fastened to box with enough machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.

4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:

   a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.

   b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.

c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.

5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.

6. Underground Concrete Pull Boxes:

a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet by 3 feet by 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inches by 10 inches in each 3 feet side, and one 20 inches by 20 inches knockout in each 2-foot side. Pull boxes with inside dimension 4 feet by 4 feet by 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8-inch by 16-inch on each of two opposite sides, and one 20-inch by 20-inch knockout on each of other two opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one-inch diameter ground rod knockout. In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4-inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required.

b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.

c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.

d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.

e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with CEC Article 250.

f. Provide 6-inch deep sand base under pull boxes.

g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.

h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer's test results for Architect's review as part of materials and equipment submittals.

i. The use of underground extension boxes shall be limited to not more than 1 times the original depth of pull box.

j. Approved Products: Oldcastle Precast, Jensen Precast, Kistner, Western Precast, or OWNER approved equal.

7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Oldcastle, Jensen, Kistner, Western Precast, or equal.

8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Floor Outlets:

1. Floor Outlets (except for extension outlets) shall be cast iron, watertight floor boxes with flush brass floor plates, and shall be set to finish flush with finish floor covering, whether it be carpeted, wood, resilient floor covering, or other finish materials.

a. Floor boxes shall be used in offices, classrooms, areas only.

b. Approved Products: Harvey Hubbell Inc. B-2503, Thomas & Betts 640 series, Legrand Omnibox, or OWNER approved equal.

2. Telephones above floor outlets, where not subject to water, shall be provided with Harvey Hubbell Inc. SC-3098 pedestals with SC309T plates. Refer to other Division 26 sections. Floor boxes shall be used in offices, classrooms and in Library areas only.

a. Approved Products: Legrand 525 series, Thomas & Betts FPT-400 Series, or OWNER approved equal

3. Plugs above floor outlets where not subject to water shall be provided with pedestal s and device plates. Refer to other Division 26 sections. Floor boxes shall be used in offices, classrooms, and library areas only.

a. Approved products: Pedestals shall be Legrand 525 series, Thomas & Betts FPT-400 Series, Harvey Hubbell Inc. SC-3098; Device plates shall be Hubbell SS309D, or District approved equal.

4. Two gang and single box pedestal boxes shall be listed for wet locations where subject to water. Provide required cover plates.

a. Floor outlets shall be used in any areas where floors are subjected to water.

b. Approved products: Single gang boxes - Hubbell SA-6687. Two gang boxes shall be Hubbell SA-6885, or OWNER approved equal.

5. Extension floor outlets shall be cast iron with cast iron covers, and 1/2-inch offset entries for above-floor conduit extensions; Boxes shall be designed to permit access to wiring without disturbing above-floor extensions and shall be set flush with finish floor.

6. Above floor service fittings for data outlets and surge suppression receptacles shall be faceplate interchangeable, die cast aluminum.

   a. Approved products: Hubbell SC3098 with cover plates SS309DS, Legrand 525 series, Thomas & Betts FPT-400 Series, or OWNER approved equal.

D. Floor Pockets – Plugging Boxes:

1. Three-Gang floor lighting pockets shall be flush floor type recess floor mounted enclosure, with cast iron floor plate and hinged cast iron door notched for cables.

   a. Each floor pocket shall be provided with three 20-amp, 3 wire, 125-volt receptacles with matching caps.

   b. Approved products: Legrand or Hubbell Recessed Floor Boxes, C.W. Cole TLS 353-6, or equal, for wood floors and C.W. Cole TLS-353-6-C, or OWNER approved equal for concrete slabs.

2. Single Gang:

   a. Receptacle floor pockets shall be single gang, flush floor type, with cast iron floor plate, hinged cast iron door notched for cable and cast-iron box. Provide each pocket with a standard, single grounding type receptacle unless otherwise indicated.

      1) Approved Products: C.W. Cole TLA-362-1-FE, or OWNER approved Legrand or Hubbell recessed floor box, or OWNER approved equal. For wood floors provide C.W. Cole TLS-362-1, or OWNER approved equal.

   b. Microphone or projector floor pockets shall be single gang flush floor type with cast iron floor plate, hinged cast iron door, notched for cable and cast-iron box.

      1) Approved Products: Legrand or Hubbell recessed floor box, C.W. Cole TLA-362-3-FE, C.W. Cole TLS-362-3, in wood floors, or OWNER approved equal.

E. Keys and Locks:

1. Provide two keys with furnished door locks, including cabinet door locks and switchboard locks, two keys for lock switches on switchboards or control panels, and two keys with interlocks or other furnished lock switches. Deliver keys to OAR.

2. Special keys and locks shall only be provided where specified. Locks shall be keyed to Corbin No. 60 or 70 as follows:

   a. Access to operate equipment shall be keyed to Corbin 60.

   b. Access to service areas shall be keyed to Corbin 70.

2.02 RECEPTACLES AND SWITCHES

A. Receptacles:

1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be wired on the side and back with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

   a. Approved products:

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20	PS5362-I	HBL5362-I	5362-I
(15 amps) NEMA 5-15	PS5262-I	HBL5262-I	5262-I

   Equal products approved by OWNER may be acceptable.

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262BL (blue), Hubbell DRUBTVSS15, Leviton 5262-SBU, 15-amps, 120-volts, or OWNER approved equal.

3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

   a. Approved products:

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361-I	HBL5361-I	5361-I
(15 amps) NEMA 5-15R	5261-I	HBL5261-I	5261-I

   Equal products approved by OWNER may be acceptable.

4. Single 15 and 20-amps receptacles on circuits supplied by panel boards with integral surge suppression shall be blue in color.

   a. Approved products: Pass & Seymour NEMA 5-20R model number 5361-BL (blue), NEMA 5-15R model number 5261-BL (blue), or OWNER approved equal.

5. Kiln and range receptacles, provide 3-pole, 4-wire, grounding type, rated 50 amps or as indicated on plans. Receptacle shall be rated 125/250 volts NEMA 14-50R. Provide 2-gang, stainless steel plates.

   a. Approved products:

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 14-50R	3894	HBL9450A	279
WALL PLATE	SS703	S703	84026

   Equal products approved by OWNER may be acceptable.

6. Dryer receptacles. Provide 3-wire, non-grounding type, rated 30 amps at 125/250 volts, NEMA 10-30R, with 2-gang stainless steel plates. Coordinate location of junction box with the work of Section 10 2815, Hand and Hair Dryers.

   a. Approved Products:

NEMA #	Pass& Seymour	Hubbell	Leviton
NEMA 10-30R	3860	HBL9350	5207
WALL PLATE	SS703	S703	84026

   Equal products approved by OWNER may be acceptable.

7. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2010 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

   a. Approved products:

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20R	2095-I	GFR5352-IA	7899-I
NEMA 5-15R	1595-I	GFR5252-IA	8598-I

   Equal products approved by OWNER may be acceptable.

8. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast lockable hinged lids and weatherproof mats;

   Tamper-resistant receptacles with thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects. Receptacles shall have extra heavy-duty brass, one-piece mounting strap with integral ground. Receptacles shall be ivory color, impact resistant nylon face and back body.

   a. Approved products:

NEMA #	Pass & Seymour	Arrow Hart	Leviton
NEMA 5-20R	TR63-I	TR8300V	8300SGI
NEMA 5-15R	TR62-I	TR8200V	8200SGI

   Equal products approved by OWNER may be acceptable.

9. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000-amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

a. Approved Products

NEMA #	Pass& Seymour	Hubbell	Leviton
NEMA 5-20R	5352BLSP	HBL5360SA	5380B
NEMA 5-15R	5252BLSP	HBL5260SA	5280B

Equal products approved by OWNER may be acceptable.

B. Switches

1. Local Switches:

a. Local switches shall be high strength thermoplastic toggle, industrial grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1I	HBL1221I	1221-2I
Double pole	PS20AC2I	HBL1222I	1222-2I
Three-way	PS20AC3I	HBL1223I	1223-2I
Four-way	PS20AC4I	HBL1224I	1224-2I

Equal products approved by OWNER may be acceptable.

b. Lock type switches shall be specification industrial grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16-inch long forks, 5/32-inch spacing between forks and 5/16-inch width overall.

1) Approved products:

	Pass & Seymour	Arrow Hart
Single pole	PS20AC1L w/#500 Key-2L	1221L w/1201LK Key
Double pole	PS20AC2Lw/#500 Key	1222L w/1201LK Key
Three-way	PS20AC3L w/#500 Key	1223L w/1201LK Key
Four Way	PS20AC4L w/#500 Key	1224L w/1201LK Key

Equal products approved by OWNER may be acceptable.

c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by Corbin, keyed to a HH41 key. Lock switch to be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the OAR. Switches shall be rated at 20 amps, 120-volt or 277-volt AC. Switch plates shall be of stainless steel, engraved with on and off positions indicated.

1) Approved products:

	Arrow Hart
Single pole	AH1191N
Double pole	AH1192N
Three-way	AH1193N

Equal products approved by OWNER may be acceptable.

d. Pilot light switches shall be rated 20 amps and shall conform to specifications for local switches. Switches shall be furnished with red, Lexan handles that are lighted by LED lamps. Pilot light shall light when load is on. Pilot light 120-volt switches

1) Approved products:

	Pass& Seymour	Hubbell	Leviton
Single pole	PS20AC1-RPL	HBL1221-PL	1221-PLR
Double pole	PS20AC2-RPL	HBL1222-PL	1222-PLR
Three-way	PS20AC3-RPL	HBL1223-PL	1223-PLR

Equal products approved by OWNER may be acceptable.

2) 20 amps, 277 volts rated pilot light switches shall be single pole and shall conform to specifications for local switches, and the requirements of paragraph d above.

a) Approved Products:

Pass & Seymour	Leviton	Hubbell
PS20AC1-RPL	1221-7PR	HBL1221-PL7

e. Provide remote control switches for mechanically held contactors arranged for 3-wire control, toggle type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles.

1) Approved products:

Pass & Seymour	Hubbell	Leviton
1251-I	HBL1557-I	1285-I

Equal products approved by OWNER may be acceptable.

f. Provide remote control switches for magnetically held contactors arranged for 3-wire control, toggle type, maintained contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclosed mechanism, and ivory handles.

1) Approved products:

Pass and Seymour	Hubbell	Leviton
1225-I	HBL 1385	1285-I

Equal products approved by OWNER may be acceptable.

g. Momentary Contact locking key type switch. 20A 120/277V center off. Key shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/32" spacing between forks and 5/16" width overall.

1) Approved products:

Arrow Hart AH1995L w/ AH2000 key
Equal products approved by OWNER may be acceptable.

h. Momentary Contact switch low voltage 1 pole 3A 24VAC 3 position center off. Key for locking switch shall be District standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/31" spacing between forks and 5/16" width overall.

1) Approved products:

Pass and Seymour Toggle 1081I, Locking 1081KGRY w/#500 Key
Equal products approved by OWNER may be acceptable.

2. Time Switches and Photoelectric Controls.

a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switchboard. Resistive or inductive contacts rated for 25-amps, each pole 240-VAC; 5-amps tungsten or 277-VAC pilot duty, each pole 240-VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable super capacitor power carry-over system. Battery carryover is not acceptable. Provide a minimum of 15 on/off set points per week. Timing to be in one-minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation.

b. Required :

1) Liquid crystal display panel.

2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.

3) Automatically adjusts to and from daylight savings time and for leap year.

4) Contact ratings: 10 amp at 240 VAC.

5) Safety override switch for each circuit to either provide shut down of circuit or to override on.

6) Selective review: All or part of schedule shall be displayed at touch of a key.

7) Super Capacitor for power carry-over system.

8) Supply voltage: 120/277-Volt.

9) 365-day advance scheduling.

c. Approved products: Tork Model EW 101B series, Intermatic ET90000 series, or OWNER approved equal.

d. Photoelectric control: Shall be rated 2,000 watts, 120V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2-inch conduit fitting,

1) Approved products: Tork series 2100, or OWNER approved equal.

3. Emergency Lighting Control Unit

a. The Emergency Lighting Control Unit shall provide all required functionality to allow a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

b. The emergency lighting control unit shall allow control of emergency lighting fixture in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.

c. The device shall have normally closed dry contacts capable of switching 10-amp emergency ballast loads at 120-277 VAC, 60 Hz., 2-amp tungsten loads at 120 VAC, 60Hz., LED loads at 120-277V VAC, 60 Hz

d. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.

e. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency)

f. The device's normal power input terminal shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.

g. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

h. Approved products: WattStopper ELCU-100 Emergency Lighting Control Unit, LVS #EPC-PM Series, Lighting Control Design #GR 2001 series, or OWNER approved equal.

2.03 IDENTIFICATION AND SIGNS

A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for switchboards, unit substations, motor control centers, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.

2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.

2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "WARNING-HIGH VOLTAGE – ABOVE 600 VOLTS". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

C. Warning Signs:

1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required reading, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2-inch high lettering.

2. Provide a warning sign on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required reading, "DO NOT OPEN UNDER LOAD". Provide 2-inch-high lettering.

3. Provide signs of standard manufacture, 18 gage steel, with porcelain enamel finish. Provide red lettering on a white background.

PART 3 - EXECUTION

3.01 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated adjustable attachment bar hangers between studs to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 Tessco A1200HS-10, Cooper B-Line B22s-HG, or OWNER approved equal channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8-inch 16 threaded steel rod with a Unistrut P-4008, Fastenal #48604, Copper B-Line 78101140346 or OWNER approved equal; nut and a Tomic No. 711-B Adapta-Stud, or OWNER approved equal. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2-inch locknut on stud and a 3/8-inch 16 hex nut locking stud to rod.

C. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted switches at 48 inches above finished floor.

2. Outlet boxes for fire alarm pull stations shall be mounted at a mounting height above finished floor that ensures that the operating handle of the initiating device is no higher than 48 inches from finished floor.

3. Wall mounted fire alarm strobe or horn/strobe devices shall be mounted such that the entire lens is not less than 80 inches above finished floor. If ceiling heights allow, wall mounted appliances shall have bottom of lens a minimum of 80 inches but not more than 96 inches to the top of lens.

4. Install outdoor fire alarm audible devices or fire alarm sprinkler flow bells at least 10 feet but not more than 12 feet above finished floor to center. Provide STI or other OWNER approved protective covers as required in plans.

5. Voice evacuation speakers mounted indoors shall be mounted in ceiling space or if mounted on wall shall not be less than 10 feet to center above finished floor.

6. Install clocks and speakers, in classrooms and offices, 7'-6" feet above finished floor. Unless otherwise indicated.

7. In rooms other than places of assembly such as, but not limited to, multipurpose rooms, auditoriums, and libraries, clock outlets and speakers in classrooms and offices shall be mounted 8 feet above finished floors. Other assembly areas such as gymnasiums shall

be mounted 10 to 12 feet above finished floor. Provide STI, or equal protective covers for clocks when required.

8. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.

9. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.

10. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.

11. Install panelboards and terminal cabinets 6 feet 6 inches from finish floor to top of cabinet.

12. Install television outlets at a height corresponding to location of television monitor, or as indicated on plans.

13. The use of extension boxes shall be limited to not more than 1 times the original depth of junction box.

3.02 COVER PLATES

A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless-steel plates. Flush lighting outlets to be blanked shall be covered with Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:

1. Three-gang and larger gang switches in locations other than classrooms.

2. Lock switches.

3. Pilot switches.

4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.

5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etcetera.

6. Receptacles operating at other than 120 V shall be identified with the operating voltage.

7. Switches operating on 277 V shall be identified with the operating voltage.

8. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

E. Standard GFI cover plates shall be Pass & Seymour 4600, Raco 5028-0, or equal. GFI cover plates shall be provided with a CAM lock mechanism with two keys or a padlock hasp that does not protrude through the face of the cover and will allow the shank of locks keyed Corbin No. 60 keys.

3.03 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points.

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit's area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.04 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 26 05 16 - MEDIUM-VOLTAGE CABLES, SPLICES AND TERMINATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies the furnishing, installation, and connection of medium-voltage cables, indicated as cable or cables in this section, and medium-voltage cable splices and terminations.

B. Single conductor 15,000 volt shielded copper power cable insulated with ozone and discharge resistant flexible, rubber like thermosetting dielectric for medium-voltage applications, suitable for use in wet and dry locations in conduit and underground ducts.

C. Related Requirements:

1. Division 01 – General Requirements.
2. Section 26 05 00 – Common Works Results for Electrical.
3. Section 26 05 13 – Basic Electrical Materials and Methods.
4. Section 26 05 26 – Grounding and Bonding.
5. Section 26 08 00 – Electrical Systems Commissioning.
6. Section 26 12 00 – Medium Voltage Transformer.
7. Section 26 13 16 – Medium Voltage Metal Enclosed Load Interrupter.

D. Applicable Standards. The most current version of the standard applies:

1. ANSI C84.1 – Electric Power Systems and Equipment - Voltage Ratings (60 Hertz).
2. ANSI/ICEA S97-682 – Standard for Utility Shielded Power Cables Rated 5 through 46 KV.
3. ANSI/ICEA S97-649 – Concentric Neutral Cables Rated 5 Through 46 KV.
4. California Electrical Code.
5. IEEE 48 – Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
6. IEEE 141 – Recommended Practice for Electric Power Distribution for Industrial Plants.
7. IEEE 242 – IEEE Protection and Coordination of Industrial and Commercial Power Systems.

8. IEEE – Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 KV Through 35 KV.

9. IEEE 404 – Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV.

10. UL 1072 – Standard for Medium-Voltage Power Cables.

1.02 SUBMITTALS

A. Provide submittals in accordance with Division 01.

B. Submit layout drawings and diagrams of cabling system configuration for Architect/Engineer's review.

C. Submit three 36 inches long pieces of the proposed cable for OWNER's inspection, evaluation and approval.

D. Submit manufacturer's cut sheets and description of products' components.

E. Submit a third-party certified test report per The Association of Edison Illuminating Companies (AEIC) CS-8 from the factory to the Project Inspector, and Architect/Engineer before installation, for each length of cable delivered to the Project site. This report shall certify compliance with the requirements of Insulated Cable Engineers Association (ICEA); the report shall include all required test data.

F. High voltage cable shall not be installed until cable and test report have been reviewed by the Architect/Engineer. Submit five copies of the report.

1.03 QUALITY ASSURANCE

G. The cable manufacturer shall have a minimum of 15 years manufacturing EPR insulated cables.

H. Cables shall be tested for corona discharge and shall comply with AEIC requirements. A copy of the original x-y plot showing discharge levels shall be included as part of the certified test reports. Submit test report for Architect/Engineer and Project's Inspector review prior to installation.

I. Tests shall be performed in accordance with (NETA Specification) ANSI/ICEA S-97-682, S-97-649 and UL Standard 1072; the tests could be performed by a UL or another approved equal Nationally Recognized Testing Laboratory (NRTL).

J. CONTRACTOR shall ensure that applicable sections of IEEE standards 141 and 242 are followed in the evaluation and installation.

K. Reels of furnished cable shall be newly manufactured of not more than 12 months old, and shall bear tags containing name of manufacturer, CEC designation, and year of manufacture.

1.04 WARRANTY

A. The following warranties are required:

1. Five-year material warranty from the manufacturer.

2. Two-year installation.

PART 2 - PRODUCTS

2.01 CABLE

A. Cables shall be insulated, shielded and jacketed, and shall be listed for wet and dry locations, sunlight resistant, and for cable tray and conduit use.

B. Medium-voltage cable shall be furnished where line-to-line operating voltage exceeds 600 volts.

C. Cables shall be 15 KV, single conductor, 133 percent insulation rating, ethylene propylene rubber insulated, shielded, PVC jacket Type MV-105.

D. Conductors shall be Class B stranded annealed, uncoated copper.

E. Insulation system conductor screens, insulation and insulation screens shall be capable of continuous operation at conductor temperatures of 120^{o} Centigrade, and emergency overload temperatures of 140 degrees C.

F. Cables shall be identified indicating manufacturer, size, insulation type, voltage rating, year manufactured, and UL, or other Nationally Recognized Testing Laboratory designations.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Installation of cable, including joints, splices, taps, bends, connections, terminations, and method of pulling cable into conduit shall be performed in accordance with manufacturer's recommendations.

B. In manholes, handholes and vaults CONTRACTOR shall provide cable(s) loop(s) to allow for future splicing and extensions. Cables shall be wrapped in fireproofing tape and properly supported per applicable codes and standards.

C. Stress cones shall be installed on cable at joints, splices, and terminations as recommended by the cable manufacturer and industry standards; the most stringent shall apply. Minimum bending radius of cable shall be in strict accordance with manufacturer’s recommendations.

D. Cable splicing shall be performed by a Certified Cable Splicer with minimum experience of five years, CONTRACTOR shall provide copy of Cable Splicer employee certification.

E. Use only environmentally safe pulling compound, approved by the OWNER’S Office of Environmental Health and Safety.

F. Cables shall be identified (labeled) at points of termination and points where conduit run is broken, as to phase leg and feeder designation. This requirement applies at man-holes, switchboards, pull boxes, and like items. Markers shall be E-Z Code, Brady Perma-Code, or equal. ID tags shall be water proof and one inch in size.

G. Each cable shall be subjected to a high potential DC test in the presence of the Inspector, Architect/Engineer, and Commissioning Agent. CONTRACTOR shall provide no less than two working days' notice of proposed time for test. Hi-Pot test shall be NETA Acceptance Values.

1. Test shall be performed with equipment specifically designed for this type of test and in a manner recommended by cable manufacturer. Copies of test report shall be submitted to the Architect/Engineer for review.

2. Test voltage shall be raised gradually in steps to final voltage recommended by ICEA, which shall be applied for five minutes. Current readings shall be taken at each step after leakage current has stabilized and readings shall be plotted on graph paper. If breakdown is indicated during test by a sudden increase in current, discontinue tests and provide replacements necessary to correct defective Work.

H. Cables not meeting test minimum requirements shall be replaced with new. Segmented replacement is not acceptable. Perform splices and terminations necessary for replacement of cable(s). Replace splices and terminations where test results indicate to be defective Work.

3.02 CABLE TERMINATIONS

A. Provide termination kits capable of proper termination of 15 KV class single conductor cables. Kits shall meet Class I requirements and be design proof tested in accordance with IEEE 48. Kits shall accommodate common forms of cable shielding and construction without the need for special adapters or accessories, and shall accommodate a range of cable sizes. Kits shall be capable of proper installation on out-of-round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available environmentally sealed connectors.

B. Terminations for single conductor shielded cables shall consist of heat shrinkable stress control and other required non-tracking insulation tubing or tapes. Kits shall also contain high relative permittivity stress relief mastic for insulation shield cutback treatment with a heat-activated sealant for environmental sealing.

C. Cable Terminator(s) shall demonstrate actual field experience and suitable accelerated and real-time testing of weathering resistance. Test reports, which verify device stability with time, temperature, and electrical stress variations, shall be submitted for review.

3.03 CABLE SPLICES

A. Splices shall be factory engineered kits that rebuild the cable insulation to that of the cable. Splices shall contain necessary components to reinstate the cable's primary insulation, metallic shielding and grounding systems, and an outer jacket.

B. Splices shall be capable of passing the electrical test requirements of IEEE-404 and water immersion tests of ANSI/IEEE 386.

C. Splices shall be of uniform cross-section, heat shrinkable polymeric construction utilizing an impedance layer stress control tube and high dielectric strength insulating layers. Outer insulating layer shall be bonded to a conducting layer for shielding. The splice shall be re-jacketed with a heat shrinkable adhesive-lined sleeve to provide a waterproof seal, or factory approved taping kit such as Scotch 5717, or equal.

D. Splices shall accommodate a range of cable sizes and be completely independent of cable manufacturer tolerances. Splices shall be capable of being properly installed on out of round cable in accordance with ICEA and AEIC standards. Kits shall accommodate commercially available connectors.

E. Splices, which consist of three or more cables, shall be performed with 600 AMP Elastamold T Bodies, Hubbell, Cooper or equal. The splice shall be capable of removing or adding a conductor and restoring the connection in an electrically safe and waterproof condition. Installation of 200 AMP T Bodies is not permitted.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE WIRES (600 VOLT AC)

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. List of Materials: Submit a complete list of proposed materials.

C. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, insulation type, resistivity, conductivity, impedance, and conductance. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

D. Prior to start of construction; provide letter from wiring and electrical cables manufacturer certifying that the products are qualified/ listed as low electromagnetic field products.

1.03 SUBSTITUTIONS

A. Deviations/Substitutions from these requirements shall not be accepted without written approval from OWNER'S Design Standards Section and Maintenance and Operations Technical Unit. When deviating are proposed the following information shall be submitted:

1. Substitution request form stating reasons and benefits to OWNER.

2. OWNER'S approval shall be obtained for any equipment or materials substitutions.

3. Proposed substitutions requests shall provide proof of compliance with OWNER'S requirements and applicable standards.

B. Submittals must comply with contract general provisions.

1.04 QUALITY ASSURANCE

A. Components and materials shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL), and in compliance with applicable industry standards and codes.

B. Wiring installation shall be performed under the supervision of state certified electricians. Contractor or Installer's electricians shall be certified in accordance with Labor Code sections 3099, and 3099.2 and section 209.0 of the California Code of Regulations.

C. Contractor shall have adequate experience installing systems of similar size and complexity.

1. Qualifications of Installer: Minimum five years of experience installing products and systems of similar scope and complexity.

2. Installer shall have completed at least five projects of equivalent scope and complexity.

3. Contractor shall have completed and commissioned a minimum of five service agreements that provide similar support services to those needed for this project.

4. System startup and testing shall be performed under direct observation of the Project Inspector and OAR.

D. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.

1.05 WARRANTY

A. Provide a one year labor warranty.

B. Provide material warranty of no less than 10 years.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

D. CONTRACTOR shall warranty all products and materials. Multiple warranty sources is not acceptable.

PART 2 - PRODUCTS

2.01 WIRES

A. Pressure cable connectors shall be pre-insulated 3M Scotchlok, Ideal Wing Nut, O-Z/Gedney or equal.

B. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at a maximum continuous conductor temperature in dry locations of 90 degrees C. and 75 degrees C. in wet locations. Wires and cables shall be listed by Underwriter's Laboratories (UL) Standard 83 for thermoplastic insulated wires and listed for installation in accordance with Article 310 of the California Electrical Code (CEC).

C. Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors.

D. Conductors shall be insulated with PVC and sheathed with nylon.

E. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted.

F. Wires shall be tested in accordance with the requirements of UL standard for types THWN and THHN.

G. Conductors shall be solid Class B or stranded Class C annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.02 STANDARDS

A. THWN/THHN wires shall comply with the following standards:

1. UL 83 for thermoplastic insulated wires.

2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values

C. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

D. Pressure cable connectors, Yellow, Red, or Blue spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems. Listed Push-in spring clamp wire connectors, Ideal In-Sure, or equal may be used in luminaires for fixture wiring.

E. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

F. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

G. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

I. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

J. Maintain the conductor required bending radius.

K. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

L. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

M. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.

   a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

   b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

   c. Test reports shall include the following:

      1) Identification of the testing organization.

      2) Equipment identification.

      3) Ambient conditions.

      4) Identification of the testing technician.

      5) Summary of project.

6) Description of equipment being tested.

7) Description of tests.

8) Test results.

9) Analysis, interpretation and recommendations.

2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.

   a. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.

3. Tests shall be performed in the presence of the Project Inspector.

4. Insulation resistance shall not be less than 100 mega-ohms.

3.02 COLOR CODES

A. General Wiring:

1. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

2. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

3. Where two voltage systems are combined in an enclosure; CONTRACTOR shall apply a permanent color code label where the circuits originate.

B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the Project Inspector. Also, refer to Div. 27 & Div. 28 for specific requirements of the systems. Except where otherwise specified, color-coding shall be as follows:

SYSTEM	COLOR CODE
Clocks	Pink, Gray and Orange

Program Bells (some existing elementary schools)	White (Common)Black
Initiating Devices (Non-Addressable)	Red (+) and Black (-)
Program Bells (some existing secondary schools)	White (120 volt, common) Black (C.R. program) Blue (Shop program) Brown (Gym program) Yellow (Auditorium fire alarm)
Fire Alarm Horns	Pink (+) and Gray (-)
Fire Alarm Strobes	Orange (+) and Blue (-)
Un-Interruptible 24 Volt Power (Annunciator, Water Flow, and Audible Device)	Yellow (+) and White (-) Note: A single white wire may be common to both
Interruptible 24 Volt Power (4 wire smoke detectors, duct detectors)	Brown (+) and White (-) Note: A single white wire may be common to both
Switch-Leg Sprinkler Bell (Between water flow and audible device)	Violet (+) and White (-)
Door Holding Magnets (Non Power Limited)	Black (+) and White (-)

3.03 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.04 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide and install an effective grounding and bonding system.

B. Related Requirements:

1. Refer to related sections for their system grounding requirements.
2. Division 01 - General Requirements.
3. Division 26 – Electrical.
4. Division 27 – Communications.
5. Division 28 - Electronic Safety and Security.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. IEEE 142 Green Book.
2. Underwriter's Laboratories (UL).
3. California Electrical Code.
4. Building Industry Consultant Services International (BICSI).
5. EIA/TIA (Signal and power).
6. Nationally Recognized Testing Laboratory (NRTL).

1.03 SYSTEM DESCRIPTION

A. Equipment, components, or materials that enclose electrical conductors, or are likely to be energized by electrical currents shall be effectively grounded.

B. Metal equipment parts such as switchboards, panelboards, metal enclosures, raceways, equipment grounding conductors, and earth grounding electrodes shall be effectively bonded into a continuous grounding path.

C. Metallic systems or electrically conductive materials shall be effectively bonded to the building’s grounding electrode system.

D. A separately derived AC system shall be grounded to the equipment grounding conductor and to a separate “made” electrode of building grounding electrode system.

E. Provide effective electrical equipment bond continuity to all metal raceways and enclosures. Grounding shall be achieved through a code sized green insulated grounding conductor provided within each raceway.

1. Each flexible conduit over six feet in length shall be provided with a green insulated grounding conductor of required size.

2. Provide code sized equipment grounding conductor in all flexible conduits as required by CEC.

3. The length of flexible conduit installations shall not be less than six feet.

4. Effectively ground metal raceways and enclosures at each end.

F. Cold water, or other utility piping systems, shall not be utilized as grounding electrodes. In addition to bonding to cold water pipe provide at least one of the following made grounding electrodes:

1. A dedicated “made” electrode, fabricated of at least 20 feet of uncoated galvanized 1/2 inch diameter rebar encased by at least two inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 exothermic welded bare copper cable, or be welded directly to the bus. The exothermic weld shall be at least four inches above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.

3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least two inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors.

4. An external grounding electrode, as specified hereafter or as required by the CEC shall be installed and connected to foundation or footing rebar.

G. Non-current carrying metal parts of high-voltage (1000 Volts or more) equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively bonded to the grounding system. Provide a CEC sized equipment grounding conductor in every raceway.

H. Metallic or semi-conducting shields and lead sheaths of cables operating above 1000 Volts shall be permanently and effectively grounded at each splice and termination.

I. Neutral of service conductors shall be grounded as follows:

1. Neutral shall be solidly grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.

2. Equipment and conduit grounding conductors shall be bonded to that grounding point.

3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.

4. Equipment grounding conductor shall be installed from switchboard to each individual building. At building, grounding conductor shall be bonded with power equipment enclosures, metal frames of building, etc., to “made” electrode for that building.

5. Feeder neutrals shall be bonded at service entrance point only; neutrals of separately derived systems shall be bonded at the source only.

J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to “made” electrode serving the building.

K. Within every building, the main switchboard or panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.04 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger.

a. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast-iron frames cast into the yard boxes.

b. Provide yard boxes with hinged Frame Locking Cover.

c. Approved products include Brooks No. 36 HFL, Jensen Precast, Oldcastle Precast, Western Precast, Kistner, or equal.

B. External ground electrodes shall be copper-clad steel ground rods, minimum 3/4-inch diameter by ten feet long.

C. Clamps and fittings used in ground boxes below grade shall be listed for direct burial.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be two inches above planting surfaces.

B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box.

C. Grounding rods shall be driven to a depth of not less than eight feet. Permanent ground enhancement material, (GEM) as manufactured by Erico Electrical Products, Loresco Powerset, Tessco Ultrafil or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.

D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.

E. When installing grounding rods, if resistance to ground exceeds 25 ohms, two or more rods connected in parallel, or coupled together shall be provided to meet CEC grounding resistance requirements.

F. Ground rods shall be separated from one another by not less than ten feet.

G. Parallel grounding rods shall be bonded together with listed fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.02 TESTING

A. Provide the services of an approved independent testing laboratory to test grounding resistance of “made” electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:

1. Visually and mechanically examine ground system connections for completeness and adequacy.

2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.

3. Perform the two-point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal hand railings at building entrances and at handicapped ramps shall also be tested.

4. Test shall be performed in the presence of the Inspector.

B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 05 33 - RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Raceways and wire ways.
2. Conduit installation.
3. Underground requirements.

B. Related Requirements:

1. Section 26 05 00: Common Work Results for Electrical.
2. Section 26 05 13: Basic Electrical Materials and Methods.
3. Division 27: Communications.
4. Division 28 - Electronic Safety and Security.

C. Applicable Standards and Codes.

1. EIA/TIA 569 Standards.
2. National American Standards Institute (ANSI).
3. National Electrical Manufacturer’s Association (NEMA).
4. Nationally Recognized Testing Laboratory (NRTL).
5. California Electrical Code (CEC).
6. Uniform Building Code (UBC).
7. Underwriters Laboratory (UL).

1.02 SUBMITTALS

A. Materials List: Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Conduit Materials:

1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each ten-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.
2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, conduits, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.

3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.

   a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.

5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.

6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.

7. Multi-cell raceway shall be four inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or District approved equal.

8. Metal Clad (MC) cable system is not allowed.

B. Sleeves for Conduits: Sleeves shall be adjustable type by Carlon, U.S. Plastic, PEP Plastic or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, equivalent Cooper Crouse Hinds Thru-Wall, Legrand Thru-Wall, or equal.

D. Expansion Joints-Seismic Separations between building(s) and other locations as indicated on drawings:

1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, Cooper XJGD or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z/Gedney type EX, Cooper XJGD, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture’s internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.

2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts, Crouse-Hinds or approved equal.

E. Conduit Seal Fittings:

1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Thomas & Betts EYS, Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Thomas & Betts EYD, Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with CEC.

2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Penetration in Fire-Rated Structures: Provide 3M, or equal, sealant and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator hoistways. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

G. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. General Requirements:

1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.

2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.

3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall be installed:

   a. For continuous lengths not exceeding more than 50 feet between pull points (pull boxes, outlet boxes, etcetera).

   b. With no maximum total raceway length located within a building interior when the flex is located in concealed locations.

4. Flexible Steel conduit shall not exceed 1-1/2 inches in size.

5. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.

6. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.

7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.

8. If connection is from a flush wall-mounted junction box, install an approved extension box.

9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.

10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.

11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not less than ten times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least six inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.

13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps. Crouse Hinds XJGD, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, Crouse Hinds XJGD, or equal. Provide Crouse Hinds, Thomas & Betts, or O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

14. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:

    a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered two inches from rear of cabinet.

    b. Conduits entering back of cabinet shall be aligned in a single row centered two inches from top of cabinet.

    c. Conduits shall not be spaced closer than three inches on centers.

15. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps. Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall

fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.

16. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.

17. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or 2” X 4” headers fitted between joists or wall studs.

18. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.

19. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.

20. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for two-inch conduit hangers and smaller and shall be 1/2 inch for 2 ½-inch conduit hangers and larger.

21. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, equivalent Cooper B-Line or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124, equivalent Cooper B-Line, or equal. Conduits shall not be stacked one on top of another, but a maximum of two tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

22. Conduits suspended on rods more than two feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.

23. Factory fabricated pipe straps shall be one or two-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.

24. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.

25. Conduits shall be supported at intervals required by code, but not to exceed ten feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.

26. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.

27. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.

28. Flex conduits shall be cut square and not at an angle.

29. Routing of conduits may be changed providing length of any conduit run is not increased more than ten percent of the length indicated on Drawings.

B. Underground Requirements:

1. Conduits and multicell raceways installed underground shall be entirely encased in three inch thick concrete on all sides, except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.

2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.

3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid-tight. Bends at risers shall be completely below surface where possible.

4. Conduits and raceways in a common trench shall be separated by at least three inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of six inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.

5. The Inspector will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the Inspector before and after placing concrete. Mandrel shall be six inches in length minimum, and have a diameter that is within 1/4 inches of diameter of conduit to be tested.

6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1 ½-inch inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic conduit for public telephone system shall be not less than ten times trade size of conduit, unless otherwise specifically permitted.

7. Furnish and install a six-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".

8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.

9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.

10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a four-inch galvanized nipple with ground bushing.

11. Underground conduit for systems operating above 600 volts shall be a minimum size of four inches.

12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.

13. Underground conduits and raceways shall be swabbed prior to wire pull.

C. Rooftop conduit shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Blok, or equal. Roller type supports shall be provided below and above conduit to prevent its dislodgement. Bottom of conduits shall clear the roof surface by 10 inches.

1. At PVC roofing provide walk tread, polyester reinforced, UV resistant, with surface embossment at rooftop supports. Heat welding of walk pads shall only be done by manufacturer certified installers.

   a. Sika-Sarnafil and Carlisle: Walk tread shall be no more than one inch larger than the plan area of the pipe support blocks and adhered to the roof membrane with Sika 1A or Carlisle Universal Single-Ply sealant, as applicable.

   b. Johns Manville: Walk tread shall be installed under the pipe support blocks and adhered to the blocks, if possible, and left loose laid on top of the PVC roof system. Walk-pad shall have a minimum of 4 inches of material past perimeter on all 4 sides of block.

2. Built-up roofing: Provide APP granulated modified torch-down at each pipe support block. Torch-down shall extend 2 to 4 inches beyond the edges of the block and adhered by torch application over existing cap sheet membrane. This work shall be performed by a certified roofer.

D. General Installation Requirements for Computer Network System Conduits:

1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.

2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.

3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than six feet.

4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than two bends of 90 degrees between pull points or pull boxes.

5. The inside radius of a conduit bend shall be at least six times the internal diameter of the conduit. When the conduit size is greater than two inches, the inside radius shall be at least ten times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least ten times the internal diameter of the conduit.

6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.

7. Splicing or terminating cables in pull boxes is not permitted.

8. For indoor application, a pull box shall be provided in conduit run where:

   a. The length is over 100 feet.

   b. There are more than two bends of 90 degrees.

   c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.

10. Where a pull box is provided with raceways, pull box shall comply with the following:

    a. For straight pull-through, provide a length of at least eight times the trade-size diameter of the largest raceway.

    b. For angle and U-pulls:

       1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least six times the trade-size diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.

       2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

          a) Six times the trade-size diameter of the raceway; or

          b) Six times the trade-size diameter of the larger raceway if they are of different size.

          c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus six times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

E. Slabs on Grade:

1. Unless specifically reviewed by the Architect and DSA, conduits 1 ¼-inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at

bottom where conduits occur to provide three inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.

2. If concrete slab is five inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

F. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, seal with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07 9200: Joint Sealants.

3.02 STUBS

A. Panelboard: Install two one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend five feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the Inspector before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.

2. Over ends of individual underground conduit stubs or groups of conduit stubs, install four-inch by 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and two inches above finished grade in planting areas. Cast a three-inch by three-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 08 00 - ELECTRICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section Includes:

1. General requirements for Commissioning (Cx) of lighting systems components, lighting controls and HVAC systems line voltage interconnection components, including installation, start-up, testing and documentation according to construction documents and Commissioning Plan (CxP).

2. Standard procedures for the execution of commissioning work shall be in conformance with Division 1, Section 01 91 13 General Commissioning Requirements. Coordinate work with the Commissioning Services Provider (CxSP).

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements.

B. Section 01 91 13: General Commissioning Requirements.

C. Section 01 79 00: Maintenance and Operations Staff Demonstration and Training.

D. Section 23 80 00: Mechanical Equipment.

E. Section 23 08 00: Mechanical Systems Commissioning.

F. Section 23 09 23: Mechanical Environmental Control and Energy Management Systems.

G. Section 23 08 13: Mechanical Environmental Controls and Energy Management System Commissioning.

H. Section 26 05 00: Common Work Results for Electrical.

I. Section 26 05 13: Basic Electrical Materials and Methods.

J. Section 26 05 26: Grounding and Bonding.

K. Section 26 05 19: Low Voltage Wires (600 Volt AC).

L. Section 26 05 86: Motors and Drives.

M. Section 26 24 19: Motor Control Center and Motor Control Devices.

N. Section 26 50 10: Solid State Lighting.

O. Section 26 09 23: Lighting Control Systems.

1.03 REFERENCES

A. Applicable codes, standards, and references: inspections and tests shall be in accordance with the following applicable codes and standards:

1. National Electrical Testing Association – NETA.

2. National Electrical manufacturer's Association – NEMA.

3. American Society for Testing and Materials – ASTM.

4. Institute of Electrical and Electronic Engineers – IEEE.
5. American National Standards Institute – ANSI.
6. National Electrical Safety Code – NESC.
7. California Building Code – CBC.
8. California Electrical Code – CEC.
9. California Green Building Standards Code (CalGreen).
10. Conglomerate for High Performance Schools (CHPS).
11. Insulated Power Cables Engineers Association – IPCEA.
12. Occupational Safety and Health Administration – OSHA.
13. National Institute of Standards and Technology – NIST.
14. National Fire Protection Association – NFPA.
15. California Electrical Code.
16. ANSI/NFPA 70B – Electrical Equipment Maintenance.
17. NFPA 70E – Electrical Safety Requirements for Employee Work Places.
18. ANSI/NFPA 101– Life Safety Code.

1.04 SUBMITTALS

A. Submittals shall include the following:

1. Submit required Cx submittals in accordance with Division 1 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxSP via the OAR.
3. List of team members who will represent the CONTRACTOR in the Pre-functional Equipment Checks and Functional Performance Testing, at least two weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, checklist documentation and field checklist forms to be used by factory or field technicians, and a copy of full details of OWNER-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of OWNER to keep Warranty in force, clearly defined.
5. Detailed manufacturer's recommended procedures and schedules for Pre-functional Equipment Checks, supplemented by CONTRACTOR's specific procedures, and Pre-functional Tests, at least four weeks prior to the start of Pre-functional Performance Tests.
6. After facility's commission is complete, submit completed Pre-functional Equipment Checklists and Functional Performance Test checklists organized by system and by subsystem. Bind information in a single package. The results of failed tests shall be included along with a description of the corrective actions taken.

1.05 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend (Cx) meetings as required under Section 01 91 13 and the Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after work required in related Division 26 Sections has been successfully completed, and tests, inspection reports and Operation and Maintenance manuals required in Division 26 Sections have been submitted and approved. The start-up and Pre-functional Equipment Checklists shall be completed and submitted to the OWNER's Authorized Representative (OAR) prior to the functional performance tests. Refer to the project's Cx Plan for more details.

1. Coordinate electrical work with the work of other trades prior to scheduling of any Cx procedures.
2. Coordinate the completion of electrical testing, inspection, and calibration prior to start of Cx activities.
3. Cx activities shall be scheduled in accordance with project's Cx plan.

1.06 QUALITY CONTROL

A. Comply with OWNER's Quality Control Specifications, Sections 01 45 16 – 01 45 19, as applicable.

B. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:

1. Provide test equipment as necessary for the equipment and systems to be commissioned.
2. Provide testing equipment and accessories that are free of defects and certified for use.
3. Provide testing equipment with current calibration labels per NIST Standards.
4. Testing equipment shall be UL Listed.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:

1. Complete all phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.
2. Start-up services required to bring each system into full operational state and ready for functional performance testing:
   a. Completion of authorized manufacturer representative's start-up procedures and recommendations.
      1. Provide Manufacture's start-up completed forms.
   b. Completion of pre-functional checklists.
   c. Copy of required manufacturer and field testing.

d. Motor rotation check.

e. Control sequences of operation.

f. Full and partial load performance.

3. If modifications or corrections to the installed systems are required to bring the system(s) to acceptance levels due to CONTRACTOR's incorrect installation or defective materials, such modifications or corrections shall be made at no additional cost to the OWNER.

4. Functional tests shall not start until each system is complete and the above items have been documented and submitted to the Engineer of Record, Cx Services Provider and OWNER for review.

B. Pre-commissioning Responsibilities: Inspection, calibration and testing of the equipment and devices necessary to commission the following systems:

1. Electrical Lighting Systems.

2. Lighting Controls.

3. HVAC line voltage electrical components.

4. Line voltage interface of Environmental Controls and Energy Management System with other systems.

5. Photovoltaic Systems.

C. Commissioning Process Requirements: Refer to Section 01 91 13 General Commissioning Requirements, related sections and Cx Plan for information on meetings, start-up plans, Pre-Functional and Functional Performance Testing (FPT), operations and maintenance data, and other Commissioning activities.

3.02 PREPARATION

A. Provide certified electricians and/or qualified personnel as required with adequate tools and equipment necessary to perform Cx activities.

B. Provide all equipment required for the commissioning of equipment and systems indicated in article 3.01.B.

C. Provide certified testing agency personnel or report(s) as required in the Cx Plan.

3.03 TESTING

A. Testing documentation shall include the following minimum information:

1. Test number.

2. Equipment used for the test, with manufacturer and model number and date of last calibration.

3. Date and time of the test.

4. Indication of whether the record is the first commissioning test, or a retest following correction of a previously identified issue.

5. Identification of the system, subsystem, assembly, or equipment.

6. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.

7. Systems and assemblies test results, performance and compliance with contract requirements.

8. Issue number and description of corrected issue that prompted retesting.

9. Name and signature(s) of witnesses and the person(s) who performed the test(s).

B. Test lighting and controls systems to verify performance, operation, functionality, light levels, energy usage, and compliance with construction documents.

1. Start up, test and document results under the observation of the CxSP.

2. Execute the Functional Performance Test (FPT) under the observation of the CxSP.

3. Provide completed and signed FPTs to CxSP for inclusion in the commissioning report.

4. Functions and Testing Conditions:

a. Occupancy sensors and timer controls for lighting:

1) Verify that specified functions and features are set up, debugged and fully operable at time of test.

2) Verify that occupant override feature functions as intended in the contract documents.

3) Verify that sensors response times/durations are set properly.

4) Test the sequence of operation for features and modes and confirm that adjustable times match the design specifications and contract documents.

5) Verify that sensors are located per manufacturer's recommendations.

b. Electric lighting dimming, photocells and controls:

1) Test the dimming controls during daytime when conditions are such that controls should be dimming electric lighting.

2) Verify that amperage changes in light fixtures are proportional to external light changes. Verify that dimmed light levels uniformity at the specified work plane remain within specified limits.

3) Verify that delays and ramp times are set and functioning so that the speed of change of light fixture output is slow enough to not bother occupants, and in compliance with the specifications.

4) Verify that dimming does not cause lower than specified light levels in adjacent "non-dimmed" spaces.

5) Verify that the controls and sensors cannot be easily overridden or disabled by occupants.

6) Verify that dimming systems in places of assembly are interfaced with the Central Fire Alarm system.

7) Verify that dimmed lighting in these areas shall come back to full bright during a fire alarm or emergency condition.

c. Illumination Levels, Night Conditions:

1) Verify that lighting throughout the building is operating automatically.

2) Test with doors closed (to simulate actual occupancy) and after finishes are complete.

d. Illumination Levels, Day Conditions:

1) Verify that lighting levels comply with average maintained foot-candle levels shown on plans.

2) Verify that lighting throughout the building is operating automatically.

2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Test at different times during the day, or under OWNER-approved simulated conditions, to ensure proper system response and to determine that lighting levels are within specified requirements.

4) In classrooms and educational spaces test the system for the different pre-determined settings. Quiet time, AV mode, all on/off, up/down dimming, and standard operations.

e. Lighting Power Density: Verify building lighting power density. Perform the test with interior lighting turned on and any manual or automatic controls temporarily overridden. Provide statement of compliance with 100% design energy report. Measurements shall be taken at least one minute after lights are turned on.

f. Emergency Lighting System: Verify that the system operates automatically under any condition, without human intervention, and that it resets back to normal operations after the power failure or emergency condition is over or cleared.

5. Acceptance Criteria:

a. Lighting Controls: For the conditions, sequences and modes tested; dimming, occupancy, photocell, and timing controls, integral components and related equipment shall respond to changing conditions and parameters defined in the Contract Documents.

b. Illumination Levels: Average light levels in the tested space at the work plane elevation shall be in the range of plus or minus 10% of the specified light level range for the space.

c. Lighting Power Density: Average instantaneous lighting power density shall be within plus or minus ten percent of that indicated in the Construction Documents.

d. Power factors on lighting circuits shall be greater or equal to 0.95, or as required by lighting fixture specifications.

e. Electrical system total harmonic distortion shall be smaller than 20%.

f. Electrical equipment AIC ratings shall be as indicated in construction drawings.

g. Feeders % voltage drop. Flag feeders with voltage drop greater than 3%.

6. Sampling Strategy for Identical Units:

a. Lighting Controls: Test all automatic interior lighting controls.

b. Illumination Levels: Test all spaces, zones and rooms to verify as proper light levels.

C. HVAC Electrical Component Testing

1. Document HVAC Division 23 electrical components using the startup procedure submitted by CONTRACTOR and accepted by the CxSP.

2. Complete and submit Start-up, Pre-functional, and Functional Checklists.

3. Verify the following information prior to HVAC system equipment startup.

a. Voltage.

b. Phase.

c. Motor Size.

d. Lock Rotor Amperage.

e. Full Load Amperage.

g. Minimum and Maximum Circuit Ampacity.

h. Feeder protection or branch circuit protection, breaker or fuse size as applicable.

4. Coordinate and check corresponding unit electrical protection.

3.04 ADJUSTING

A. Incorrect installations, including improper adjustments may result in additional work being required for Cx acceptance.

1. Perform work required to correct installations not meeting contract requirements at no additional cost to the OWNER.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

1. Refer to the Cx Plan for retesting requirements necessary to achieve required system performance.

2. If the systems' Cx deadline, as defined in the Cx Plan, goes beyond the scheduled completion of commissioning without resolution of the problem, the OWNER reserves the right to obtain supplementary services or equipment to resolve the problem.

a. The cost of additional and/or supplementary services inquired by OWNER as a result of CONTRACTOR's lack of performance, or inability to resolve identified issues will be solely the responsibility of the CONTRACTOR.

3.05 TRAINING

A. Provide training and documentation as required in construction documents.

END OF SECTION

SECTION 26 09 23 - LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Low-voltage lighting control system.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 05 00 – Common Work Results for Electrical.
3. Section 26 05 13 – Basic Electrical Materials and Methods.
4. Section 26 05 19 – Low-Voltage Wires (600 Volt AC).
5. Section 26 05 33 – Raceways, Boxes, Fittings, and Supports.
6. Section 26 08 00 – Electrical Systems Commissioning.
7. Section 26 24 16 – Panelboards and Signal Terminal Cabinets.
8. Section 26 50 00 – Lighting.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Submit a complete one-line diagram of the proposed system configuration for Architect/Engineer’s review. The riser diagram shall identify but not be limited to wiring, equipment, components, interconnection with other systems, and location and type of raceways.

C. Manufacturer's Data: Submit catalog cuts and description of each system component.

D. Provide wiring diagrams and installation details for lighting control equipment.

E. Provide a complete sequence of operation and system interface requirements with fire alarm, and other applicable systems as depicted in construction documents.

F. Shop Drawings: Submit a complete set of detailed Shop Drawings for the entire lighting control system; the shop drawings shall include but not be limited to relay panels with designations and dimensions, day light sensor locations based on manufacturer’s recommendations, and system components with manufacturer’s part numbers.

G. Installation Instructions: Submit manufacturer's written installation instructions, wiring diagrams. Instructions shall include recommendations for handling of equipment and parts, and protection and storage requirements.

H. Software flow diagram of and complete sequence of operation.

I. Software licenses and electronic keys, and list of assigned passwords.

J. Supplemental local or factory training schedule for post warranty support.

K. A complete list of recommended spare parts with pricing for the OWNER's use in keeping the environmental control system downtime to a minimum.

1.03 QUALITY ASSURANCE

A. Components shall be listed and labeled by Underwriter's Laboratories (UL), or another Nationally Recognized Testing Laboratory (NRTL).

B. Lighting control system and peripheral devices with IP addresses shall be UL listed in compliance with UL-2900 – Cyber Security Network Connected Systems.

C. Lighting Control Systems shall comply with the state of California Building and Electrical Codes, and Title 24 energy requirements in effect at time of submittal for building permit.

D. Conduct a coordination meeting with the lighting control contractor, electrical contractor, EOR, Manufacturer Representative, Commissioning Agent, and the OAR to validate the location of lighting control system components, including daylight, vacancy, motion sensors. Sensors shall be located based on manufacturer's recommendations.

E. Systems components shall be Title 24 compliant and listed as California Energy Commission approved products.

1.04 WARRANTY

A. Manufacturer shall provide a three-year material warranty.

B. Installer shall provide a two-year installation warranty.

1.05 TRAINING

A. Provide a competent instructor who is factory trained and has comprehensive knowledge of system components and operations to provide full instructions to designated personnel in the system operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems.

B. Training shall include system overview, time schedules, override commands, emergency operation, and programming and report generation for school based non-technical personnel.

C. Provide an eight hours OWNER's personnel and Maintenance and Operations technical employees training session; this training session shall cover and provide the following:

1. As-built drawings of System layouts and point to point connection diagrams.

2. System components cut sheets.

3. Operations and maintenance data.

4. Programmer and maintenance training: database entry; trend logs application programs, diagnostic routines, reporting, failure recovery and calibration, and expose the trainees to system's features, components, system architecture, operations, programming, report generation, communications, reading and interpreting alarms, and any other pertinent information required for the operations and maintenance of the system.

5. Training sessions shall accommodate a minimum of 20 persons and be facilitated at CONTRACTOR's training facility, which should be no more than 50 miles from the Project Site.

6. Obtain OWNER's approval for training locations exceeding 50 miles. In such cases, the CONTRACTOR shall be responsible for transportation expenses.

7. CONTRACTOR shall provide training computers for all attendees. Computers shall be ready for live training sessions.

8. Instructor(s) shall give the trainees the opportunity to practice on simulated and actual (installed) systems.

D. The training session shall have an itemized agenda covering all aspects of the training to be covered in the sessions. CONTRACTOR shall obtain agendas approval from OWNER and Commissioning Agent.

1.06 SYSTEM REQUIREMENTS

A. The lighting controls shall be a centralized system furnished with digital room controllers, capable of working as a network system that communicates via common data line (s).

B. The system shall be furnished with transformers, control electronics, hardware, resident software and complete programming, occupancy sensors, constant light controllers, exterior light sensors, photocells, digital and analog switches, dimmer switches, conduit and wiring for a complete and functional installation.

1. Software shall be resident within the lighting control system.

2. System shall provide local access to programming functions at the master Lighting Control Panel (LCP) and remote access to programming functions via computers or other intelligent communication devices running an industry standard internet browser.

3. System software shall provide real time status of all components and ancillary devices.

4. For on-site access, the lighting control system shall have a built-in touchscreen allowing authorized access to localized control and programming

C. Areas controlled by a motion sensor; such as rooms with one luminaire and emergency fixtures designed to operate 24 hours a day, seven days a week shall be programmed accordingly.

D. The system shall have a server built into the master LCP. The server shall effectively work/operate through HTML pages from any authorized workstation.

1. WEB front end shall be accessible over an OWNER provided Ethernet 10/100 Mpbs to the local area network.

2. Protocol shall be TCP/IP and allow either http (hypertext transfer protocol) or https (hypertext transfer protocol secured) connections.

E. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital, non-server capable systems are not acceptable.

F. Lighting control system shall be able to be monitored and take commands from a remote Personal Computer (PC); should the remote PC go off-line system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on-line PC or server for normal operation are not acceptable

G. Devices shall be factory pre-addressed but be able to be field addressable also. Systems requiring field addressing only are not acceptable.

H. Programs, schedules, time of day, etcetera, shall be held in non-volatile memory at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.

I. System shall be capable of flashing lighting OFF/ON for any relay or lighting zone prior to the lights beings turned OFF. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled OFF sweep using local lighting zone override switches within the zone or occupied space. Occupant override time shall be pre-programmed not to exceed two hours, or current California Title 24 requirements.

J. The system shall be capable of implementing ON, OFF, Raise (dimming), and Lower (dimming), and preset commands, group or zone by means of devices connected to programmable inputs in the lighting control system.

K. Programming and scheduling shall be done at the master LCP and/or remotely via the Internet. Remote connections shall function in real time control and real time feedback.

L. System may consist of centralized relay panels, room controllers, digital switches, analog switches, photocells, motion sensors, lumen control devices, dimmer switches, and various digital interfaces. All system components, including remote and centralized room controllers, digital switches, etc. shall operate and be integrated as a network.

1. Remote Room Controllers (RRC) shall control lighting fixtures in that area or space.

2. The RRC shall provide power to ancillary and control devices, such as occupancy sensors, and take input from controlling devices, such as daylight and occupancy/vacancy sensors.

3. RRC’s shall be capable of taking inputs from OWNER specification line voltage type switches.

M. RRC, switches, photocells and occupancy sensors, and ancillary devices and components shall be integrated per lighting control manufacturer's instructions.

N. Location of devices and relay panels or relay controllers installed above ceilings shall be identified with a printed label attached to ceiling elements. Locate label directly below equipment location.

1.07 LIGHTING CONTROL OVERVIEW-BY AREA CONTROLLED

A. Rooms:

1. The rooms shall be controlled by a combination of vacancy sensors, daylight controllers and dimmers switches.

a. The vacancy sensor is to automatically switch lights OFF when the room is not occupied for 15 minutes.

b. Daylight controls shall automatically adjust light intensity according to the natural light level in the room to maintain a uniform level of lighting in the range of 30-50 foot-candles.

c. The daylight sensors shall be enabled and disabled by the vacancy sensors to ensure daylight-controlled lights never automatically turn ON when room is unoccupied. The lighting control system shall allow an authorized person to disable the daylight sensors and dimming controls.

d. Wall switches, and dimmers are to manually switch lights ON and OFF. Switches shall comply with the operational requirements of the current T24, and include location of device, accessibility and override capability.

e. Quiet time switch is to temporarily bypass the occupancy sensors for a pre-programmed period of one hour, or as indicated on drawings.

B. Corridors and Open Areas:

1. Corridors and other common areas are to be controlled by a combination of programmable low voltage keyed switches and time schedules supplied by the networked lighting control system.

a. Low voltage keyed switches are operable 24 hours a day and are to manually switch lights ON and OFF.

b. The central timer is to automatically sweep lights OFF after hours and provide scheduling capability where and when occupancy sensors are not used.

c. Interior corridors require occupancy sensors.

C. Custodial, Unsupervised and Equipment Rooms:

1. Provide occupancy sensors with automatic on-off capability in addition to manual switches, and programming features indicated on plans. These sensors shall turn off

the lights in the room via 15 minutes pre-set programmable interval after the room has been vacated.

D. Exterior Security Lights:

1. Program exterior wall packs and security lights to be controlled via exterior light sensors, and time switches as indicated on drawings.

   a. Program lights to ON state when natural lighting is below 5 foot-candles

   b. Program lights to OFF when natural light level is greater than 5 foot-candles.

E. Exterior, Non-Security Lights:

1. Exterior non-security lighting in parking lots, corridors and pathways, and decorative lights shall be controlled via exterior light sensor working in conjunction with programmable controlled time schedules via the lighting control system.

   a. Program lights to ON state when natural lighting is below 5 foot-candles, and when scheduled time is set to ON.

   b. Program lights to OFF state when natural light level is greater than 5 foot-candles, and when scheduled time is set to OFF.

F. Restrooms:

1. Student Restroom and Lactation Room Lighting and Exhaust Fans (Fans interlocked with lights):

   a. Restroom lights shall be controlled from the lighting control panel via assigned relays.

   b. Provide by-pass lock type, vandal resistance key operated switch adjacent to the door, and ceiling mounted occupancy sensors for on/off controls.

   c. The sensor shall turn off the lights via a programmable pre-set 15 minutes interval, after the room has been vacated.

2. Staff Restrooms Lights and Exhaust Fans (Fans interlocked with lights):

   a. Restrooms lights and fan shall be controlled from the lighting control panel via assigned relays.

   b. Provide ceiling mounted occupancy sensors, and by-pass toggle switches for system override adjacent to the door.

   c. The sensor shall turn off the lights via a programmable pre-set 15 minutes interval, after the room has been vacated.

G. Emergency Lighting:

1. Provide emergency lighting controls circuitry to achieve override or bypass of manually operated switches, lighting control systems, dimmers and occupancy sensors during power failures.

2. Each area of luminaries or groups of luminaries shall be equipped with and be controlled by a UL924 listed emergency lighting control unit to allow the detection of localized power failures.

PART 2 - PRODUCTS

2.01. CENTRAL LIGHTING CONTROL PANELS

A. Central Lighting Control Panels (CLCP) shall be located in electrical closets.

B. Panels shall be surface or flush mounted type as indicated on Drawings, with a hinged door assembly. Doors shall be furnished with flush type locks, spring latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys. Panels shall include the following components or features:

1. Shall be preprogrammed and preassembled with control equipment and relays as indicated on the lighting plans.

2. Shall be equipped with suitable dividers separating Class 1 and Class 2 compartments, 120V and 277V compartments as well as “normal and emergency” compartments.

3. Lighting control relays as indicated on Drawings. Provide 10 percent spare relays for centralized relay panels up to the maximum capacity of panel.

4. Shall be equipped with a neatly typewritten schedule with number and name of rooms or areas served by the relay circuits. Room numbers and names used shall be determined at the Project site and may not be those indicated on Drawings. Schedule shall indicate panel designation and voltage and shall be mounted in a frame under transparent plastic 1/32-inch-thick on inside of panel cabinet.

5. Each panel shall be rated for 120 or 277 VAC.

6. Shall be preassembled, preprogrammed and include relays capable of switching 20 amps lighting loads for 120 or 277 VAC.

7. Central lighting control panels, remote lighting control panels, relays, low voltage switches, interior light sensors, exterior light sensors, and associated control electronics shall be furnished by Lighting Control and Design (LC & D), Douglas Lighting Controls, or equal.

8. Approved products: Douglas Dialog Series, LC & D #GR-2400 series, or equal.

2.02. REMOTE ROOM CONTROLLERS

A. Remote Room Controllers (RRC) shall be mounted in the ceiling space as indicated on plans.

1. Each RRC shall be connected to the network lighting control system using manufacturer's recommended wiring method and configuration.

2. Provide a printed label "RLCP" to the T-bar grid below the RRC".

3. Approved products: LC&D GR-2404 Series or Douglas WRC-4244.

B. Each RRC shall contain the following hardware features:

1. Digital dataline switch inputs.

2. 12 VDC and 24 VDC inputs for occupancy sensors requiring DC voltage for analog occupancy sensors, or Digital dataline type inputs for occupancy and light sensors.

C. Switches shall be capable of switching individual relays, local groups of relays within the panel or global groups of relays system wide. Each switch shall be configured to be ON, OFF, RAISE, LOWER, or Toggle.

D. The RRC shall digital dataline occupancy sensors. The sensors shall be configured for OFF only or ON/OFF switching scenarios.

E. Photo sensor shall be linked with occupancy sensing so that when light levels are high enough, the occupancy/vacancy sensor will not switch the photo-controlled relays ON.

2.03 RELAYS

A. Relays shall be warranted for a minimum of three-years.

B. Relays shall be individually added or replaced. Lighting control systems incapable of replacing individual relays are not acceptable.

C. Each lighting control relay shall be capable of controlling LED sources.

D. Approved Products:

1. Single Pole: Douglas WR-6161, LC&D SL-277-NC, or equal.

2. Double Pole: Douglas WR-6172, LC&D SL-480-NC, or equal.

2.04 LOW VOLTAGE SWITCHES

A. Low voltage switches shall be wired in compliance with manufactures requirements. Digital switches shall be part of the lighting control system network.

1. Provide stainless steel switch plates, unless noted otherwise in construction documents.

2. Approved Products: LC&D Chelsea series, Douglas WSW-3500 series, or OWNER approved equal.

B. Physical removal of any single switch shall have no effect on the communication between relay panels in the rest of the lighting control network. Lighting control systems requiring the continuous connection of all low voltage switches are not acceptable.

C. Keyed switches shall be digital.

1. Approved products: Douglas WSK-35XX Series, LC&D KS Series, or equal.

2. Provide stainless steel switch plates, unless noted otherwise in construction documents.

D. High abuse areas (common areas, Assembly, class Labs, etcetera) shall be controlled using a vandal resistant, touch sensitive high abuse switch and available with up to three buttons in a single gang. Multi gang versions shall also be available.

1. Touch pads shall be stainless steel and capable of handling both high abuse and power wash cleaning crews' activities.

2. Switches shall be digital or analog as indicted on plans.

3. High abuse switch touch buttons shall control a single relay or group(s) of relays of the lighting control system.

4. Touch buttons shall be controllable via programmed commands to enable or disable, ON, OFF, Toggle or Maintain operation functions. Programming shall be done locally or remotely.

5. Touch pad(s) shall be identified as to function by an engraved label.

E. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cm spark) without any interruption or failure in operation.

2.05 INTERIOR DAYLIGHT SENSORS

A. Interior daylight sensors shall cause light fixtures to brighten or dim to maintain pre-determined and uniform light levels.

B. The sensors shall permit any relay to switch at a unique light level and shall attempt to maintain a constant light level by switching individual relays ON or OFF as the ambient light level changes.

C. Controllers offering single set point controls are not acceptable.

D. Each interior daylight sensor shall continuously monitor the true light label and shall broadcast this level to lighting control network. Controllers requiring readings at the sensor head itself are not acceptable.

E. Each interior daylight sensor shall be fully adjustable via the lighting control software. Controllers requiring adjustments at the sensor head are not acceptable.

F. Provide daylight sensors in all rooms with windows. Refer to lighting plans to determine which switch legs are controlled by the daylight controller.

G. Approved Products: LC&D iPC Series, Douglas WPS-3711, Douglas WPP-INT, or equal.

2.06 EXTERIOR LIGHT SENSORS

A. One exterior light sensor shall permit different relays to switch at different light levels. Sensors offering less than 14 remotely settable trip points are not acceptable.

B. Exterior light sensor shall continuously monitor light levels and shall broadcast this level over the lighting control network. Exterior light sensor shall be fully adjustable via the networked lighting control system.

C. Sensors and controllers requiring adjustments at the sensor head are not acceptable.

D. Sensors shall be UL or NRTL listed for exterior application.

E. Approved products: Douglas WPS-3741B, LC&D PCO, or equal.

2.07 DIMMING CONTROLLER

A. Remote relay panels shall be capable of outputting 0V – 10V dimming signal for each relay provided in the remote room controller. LED Dimming drivers shall be controlled by industry standard 0V-10V control input.

B. LED Drivers using proprietary control protocols shall not be acceptable.

C. To maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid point, end point, trim fade up rate, fade down rate, time delay and enable/disable masking.

D. Photocells settings must be remotely accessible.

E. Systems that provide ON, OFF with Time Delay only and systems that do not provide remote accessibility are not acceptable.

F. Mount photocells in locations indicated on plans and according to manufacturer's recommendations for daylight system type, open or closed loop. Trip points shall be able to be programmed and altered remotely via programming functions at the master Lighting Control Panel (LCP) and remote access to programming functions via computers or other intelligent communication devices.

G. Photocells requiring manual trip point adjustment, or systems that provide local adjustment only are not acceptable.

H. Photocells used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up rate, fade-down etc.

I. Approved Products: Douglas WPS-3711, Douglas WPP-INT, LC&D iPC series, or equal.

2.08 OCCUPANCY SENSORS

A. Occupancy Sensors:

1. Ceiling-Mounted Dual Technology Sensors:

a. Sensors shall be dual technology infrared-ultrasonic capable of detecting presence in floor area to be controlled, by detecting Doppler shifts in transmitted ultrasound and infrared technology.

1. ADI-Voice technology may be used in addition to the required infrared-ultrasonic features.

b. Detection shall be maintained when a person moves only within a maximum distance of 12 inches, in either a horizontal or vertical manner, at approximate speed of 12 inches per second. Lights shall not go off when a person is reading or writing while seated at a desk.

c. Each sensor shall be furnished with a convenient shunt provision, which will enable a person to by-pass sensor in event of failure.

d. Sensitivity shall not change more than ten percent in temperature range of 0 degrees F. to 120 degrees F., and in humidity range of ten percent to 80 percent. Sensitivity adjustment shall be provided for each technology.

e. Time delay range shall be adjustable from 15 seconds to 15 minutes.

f. Sensors power supply shall be provided by power pack, consisting of a transformer and contact closure relay in one package. Power output of transformer shall be capable of operating a minimum of two sensors.

g. Approved products: Watt Stopper No. DT-200, similar as manufactured by Leviton, Sensor Switch, Unenco, or equal.

B. Dual Technology Passive Infrared Wall Switch Sensors with Daylight Controls:

a. Sensors shall be capable of detecting presence in floor area to be controlled, by detecting changes in infrared-ultrasonic energy. Small movements shall be detected such as when a person is writing while seated at a desk.

b. Passive infrared sensor shall utilize a dual-element sensor and a multi-element fresnel lens.

c. Sensor shall be furnished with a daylight filter which ensures that sensor is insensitive to short-wavelength infrared waves, such as those emitted by the sun.

d. Sensors shall be furnished with convenient bypass provisions, which enable lighting to be turned on in case of failure.

e. Time delay range shall be adjustable from 15 seconds to 15 minutes.

f. Sensitivity adjustment shall range from 0 (off) to ten (maximum).

g. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering with adjustments and hardware.

h. Each sensor shall cover up to 800 square feet, with a field-of-view of 180 degrees.

i. Sensor shall be a completely self-contained control system.

j. Power shall be provided via an internal transformer.

k. Switching mechanism shall be a latching dry contact relay.

l. Sensor shall be capable of switching from 30 to 1000 Watts, LED, incandescent or fluorescent light sources.

m. Sensor shall be furnished with a daylight feature, adjustable from ten to 400 foot-candles, that maintains lighting off when a desired foot-candle level is present.

n. Sensors shall be dual voltage, 120 volt and 277 Volt.

o. Approved products: Watt Stopper No. WI 200, I 300, similar as manufactured by Leviton Sensor Switch, Unenco, or equal.

2.09 UNIT INVERTERS

A. Unit Inverters shall be rapid start type consisting of emergency power packs designed to be installed in channels of new lighting fixtures.

C. Power pack construction shall be of durable polycarbonate housing.

D. Units shall be furnished with test switches and pilot lights.

E. Units shall automatically power designated lamp(s) for 90 minutes of emergency service upon failure of utility power.

F. Upon return of utility power, battery shall automatically recharge.

G. Batteries shall be field-replaceable, sealed, rechargeable, spill-proof, maintenance-free nickel cadmium.

H. High efficiency inverter/charger design shall include low-voltage disconnect to prevent deep discharge of battery and dual voltage designed for connection to either 120 or 277 volts. Chargers shall recharge fully discharged batteries to provide 90 minutes operation within 24 hours. Power pack shall not operate if shut off manually.

I. An unconditional five-year warranty is required.

J. Approved products: Dual-Lite UFO-5 Series, Bodine, Iota I series, Beghelli Luce, or equal.

2.10 INTERFACE TO BUILDING MANAGEMENT SYSTEM

A. When interface to the Building Management System is required, The lighting control system shall provide a BACnet/IP interface module that communicates with the BMS via a BACnet/IP network. (a collection of one or more IP sub networks (IP domains) that are assigned a single BACnet network number). Verify if interface to BMS is required.

B. BACnet/IP interface module shall provide the capability for the BMS to:

1. Communicate directly with each relay in the lighting control system network and each group used within the lighting control system.

2. Monitor the status and status changes of each relay and each group.

C. Install wiring and confirm operation of the lighting control BACnet/IP interface module per the lighting control manufacturer's instructions. Installing, wiring, and interfacing of BMS components to the lighting control system.

PART 3 – EXECUTION

3.01 GENERAL

A. Lighting control system shall not be used for ay other purpose other than its intended use and application.

B. Provide required interconnections with other systems such as emergency power sources, fire alarm systems, and building management system as required or indicated on drawings.

C. Installation shall meet or exceed standard practice of workmanship and quality.

D. Drawings are diagrammatic in nature and indicate work to be provided, but do not provide means and methods, bends, transitions, or special fittings required to clear beams, girders or other work already in place. Investigate conditions where conduits are to be installed and furnished and install required fittings.

3.02 INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's drawings for location of line and low-voltage areas.

B. Provide for digital type switches and make all connections according to lighting control manufactures requirements.

C. Central Lighting Control Panels and Remote Room Controllers shall be connected via a data line (Douglas uses a non-polarized two No. 18 and LC&D uses Cat5 four twisted pair cable, with RJ45 end connectors). Connect entire lighting control system per manufacturer's requirements. Do not exceed manufacturer's total data line length requirement.

D. Panels shall be located so that they are readily accessible and not exposed to physical damage.

E. Panel locations shall be furnished with enough working space around panels to comply with the California Electrical Code.

F. Panels shall be securely fastened to the mounting surface by at least four points.

G. Unused openings in the cabinet shall be effectively closed.

H. Cabinets shall be grounded in accordance with Article 250 of the California Electrical Code, and manufacturer's recommendations.

I. Lugs shall be suitable and listed for installation with the conductor being connected.

J. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

K. Maintain the required bending radius of conductors inside cabinets.

L. Clean cabinets of foreign material such as cement, plaster and paint.

M. Distribute and arrange conductors neatly in the wiring gutters.

N. Follow the manufacturer's torque values to tighten lugs.

O. Before energizing the panelboard, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.

2. Remove shipping blocks from component devices and the panel interior.

3. Remove debris from panelboard interior.

P. Follow manufacturers' instructions for installation.

3.03 OPERATING/SERVICE MANUALS

A. Service and Operation Manuals:

1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.

2. Record drawings: Provide (3) printed and one electronic copy on flush media of as built documents in latest version of ACAD of the entire system; including, floor plans with equipment, and devices layouts and wiring, interconnections with other systems, conduit and cable runs, programmed configurations, sequence of operations, system labeling codes, system passwords, and other pertinent information.

3. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both

underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.

3.04 PROTECTION

A. Protect all work, equipment and components of the lighting control system until Substantial Completion.

3.05 TESTING

A. Set-up, commissioning and testing of the lighting control system, and OWNER instruction shall include:

1. Confirmation of system programming.

2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.

3. Operation of system's features under normal and emergency operations.

4. Before energizing check and demonstrate in the presence of the Project Inspector that cables and wire connections are free from short circuits, ground faults, and that there is continuity, and necessary insulation.

5. Confirm system operations and functionality.

6. Check system interface response to other systems such as fire alarm and emergency power system conditions.

3.06 SPARE PARTS

A. Provide a minimum of five percent spare parts of each type of relay, sensors, switches, and peripheral devices.

3.07 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 09 61 - PERFORMANCE LIGHTING SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes furnishing the following equipment for installation as described under Section 260963:

1. Dimmer Racks
2. Dimmer Modules
3. Intelligent Breaker Panel
4. Panic Control System
5. Emergency Lighting Transfer System
6. Equipment Racks
7. House & Work Lighting Controls
8. Lighting Control Console & Accessories
9. Performance Lighting System Ethernet Network
10. Control Device Faceplates
11. Performance Lighting Outlet Devices
12. Spare Parts

B. Related sections include the following:

1. Performance Lighting Systems Installation
2. Common Work Results for Electrical
3. Interior Lighting Fixtures
4. Loose Performance Lighting Fixtures
5. Acoustical Shells
6. Rigging Systems and Draperies
7. Commissioning of Electrical Systems

1.3 FULLY WORKING SYSTEMS

A. Review Drawings and Specifications that affect work in this Section.

B. Notify Architect upon indication that work in this Section cannot be completed as specified or scheduled.

C. Provide additional parts or devices required for functional requirements of control systems at no extra cost to Owner.

1.4 DEFINITIONS

A. Dimmer Rack: Cabinet accommodating dimmer modules, load and line connections, and circuit protection.

B. Plug-In Module: Modular unit that installs in standardized mounting location within dimmer rack.

C. Dimmer Module: Plug-in module containing one or more dimmers.

D. Control Module: Plug-in module containing centralized control electronics for dimmer modules.

E. Data Communication Protocol: Signal that provides control and feedback communications between devices in control system.

F. DMX 512: Data communications protocol compliant to USITT DMX-512/1990 specification (ANSI E1.11-2004).

G. RDM: Data communications protocol compliant to ANSI/PLASA Remote Device Management specification (ANSI/PLASA E1.20 RDM).

H. ACN: Data communications protocol compliant to ANSI/PLASA Architecture for Control Networks specification (ANSI E1.17-2006 ACN & E1.31 Streaming ACN).

I. POE / Power Over Ethernet: 802.3AT compliant scheme of powering devices on an Ethernet system.

1.5 QUALITY ASSURANCE AND STANDARDS

A. References to code, standards, specifications, and recommendations of technical societies, trade organizations, and governmental agencies will refer to the latest edition of such publications adopted and published prior to bid submittal. All codes and standards will be considered a part of this specification as if they were fully included.

B. Work and materials shall comply with rules and recommendations of:

1. Prevailing national, state and local building codes.
2. UL, ETL, cUL, CSA and CE Labels – where materials and equipment are available under the continuing inspection and labeling service of applicable independent product testing and certification services, provide such labels, materials, and equipment.
3. National Fire Protection Associate (NFPA) Publication: National Electrical Code, NFPA70 as applicable to installation and construction of performance lighting and control equipment.
4. NEMA Compliance pertaining to components of performance lighting equipment.
5. United States Institute for Theatre Technology, Inc. (USITT) DMX512/1990 (ANSI E1.11-2004).
6. ANSI/PLASA Remote Device Management (ANSI/PLASA E1.20 RDM) and Architecture for Control Networks (ANSI E1.17-2006 ACN & E1.31 Streaming ACN) standards.
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE) 802.3 and 802.11n.

1.6 SUBMITTALS

A. Bid Submittals

1. Bill of materials: Identify parts by common industry standard numbers and descriptions.
2. Cut Sheets: Manufacturer’s catalog datasheets of all products listed in bill of materials.
3. Statement: Manufacturer agrees to warranty provisions.
4. Projected Timetable: List time in weeks for following activities:

    a. Shop drawing preparation
    b. Fabrication
    c. Shipping to site
    d. System commissioning
    e. As-built drawing preparation

B. Shop Drawings

1. Format: Uniform sheet size.
2. Binding: Bind shop drawings of more than five drawings.
3. Shop drawings shall include:

    a. Pictorial drawings: All major components, sub-assemblies, parts list, dimensions, material and finish notes, quality assurance listings.
    b. Wiring diagrams: Components and interconnections to other components.
    c. Bill of materials: Accessories and spare parts not drawn.
    d. Not acceptable: Catalog cut sheets.

4. Review: Fabrication shall not commence until Theatre Consultant and Architect determine that the shop drawings are in compliance with design intent of Contract Documents.
5. Revisions: Resubmit as required.

C. Manuals

1. Format: Letter and/or tabloid size paper.
2. Binding: Standard 3-ring binder.
3. Electronic Format: PDF files on USB flash drive.
4. Manuals shall include:

   a. System description.
   b. Operation instructions, including safety measures.
   c. Maintenance instructions, including recommended procedures and schedules for inspecting system components.
   d. Catalog cut sheets for all purchased equipment.
   e. Recommended spare parts list.

D. As-Built Drawings

1. Format: Letter and/or tabloid size paper.
2. Binding: Standard 3-ring binder.
3. Electronic Format: PDF files on USB flash drive.
4. Delivery: Within one month of system acceptance.
5. As-built drawings shall include:

   a. Drawings of all system components.
   b. Control schematics and risers.
   c. Bill of materials.

1.7 PROJECT CONDITIONS

A. Submit: Written confirmation that related electrical work, as shown on Drawings, provides necessary physical accommodations or installation and operation of equipment.

B. Delivery: Within three weeks of award of contract.

1.8 WARRANTY

A. Manufacturer shall warrant equipment as follows:

1. According to guarantee provisions in General Conditions.
2. For two years from acceptance of systems, provide services detailed below:

   a. Technical and Operational Assistance Hotline: Shall be available during normal working hours, evening, and weekends at no additional cost.
   b. In-stock Spare Parts: Available for major assemblies within 24 hours of contact.

      1) Additional Cost: No charge during duration of warranty for exchanges not caused by misuse.

   c. Warranty period: Commence upon final acceptance by Owner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. The equipment shall be manufactured by the following:

1. Electronic Theatre Controls
   3031 Pleasant View Road

Middleton, WI 53562
608.831.4116

2. Strand Lighting
10911 Petal St
Dallas, TX 75238
214.647.7880

B. The equipment shall be supplied by only one of the following:

1. 4Wall Los Angeles
5435 W. San Fernando Road
Los Angeles, CA 90039
818.252.7481
2. BCT Entertainment
1281 N La Loma Circle
Anaheim, CA 92806
714.237.9270
3. Polaris Lighting
624 Irving Ave
Glendale, CA 91201
818.265.0330
4. PRG Los Angeles
1245 Aviation Place
San Fernando, CA 91340
818.252.2600b
5. Pro Sound & Video
11060 Randall Street
Sun Valley, CA 91352
818.765.3800

C. Additional companies wishing to bid shall submit the following 10 days before submission of bids, for review and approval by Theatre Consultant:

1. Firm history.
2. List of completed installations, comparable in scope to the job described here.
3. Minimum of 5 representative shop drawing sheets.
4. If requested, a current certified financial statement showing sufficient financial base for the size of job described here.

D. Furnishing: Equipment and services shall be provided by one manufacturer.

E. Experience: Manufacturer shall have been continuously engaged in production of performance lighting and control equipment for at least 20 years.

F. Emergency Support: Manufacturer shall have a toll-free, 24 hour emergency phone line. Response shall be within 30 minutes of phone call.

G. Substitutions: Substituted equal products shall not be allowed without prior approval of Architect, Electrical Engineer, Theatre Consultant, or Owner.

H. New products: Provide latest model of specified products provided latest model retains or exceeds characteristics of products specified herein. Manufacturer shall provide demonstration for Architect, Electrical Engineer, Theatre Consultant, or Owner.

I. Testing: Test and label all equipment at factory prior to shipment.

2.2 PARTS

A. All materials and equipment provided shall be new and of high quality.

2.3 GROUNDING

A. These systems shall be grounded, as shown on Drawings and in accordance with applicable codes and regulations and/or at the advice of the Manufacturer.

2.4 CIRCUIT BREAKERS

A. Conformity: All applicable codes and standards.

B. Interrupting capacity: 10,000 amperes SCCR for all primary and secondary circuit breakers unless otherwise specified.

C. Toggle Guard: Provide for branch circuit breakers in equipment rack component mounting panels, control device faceplates, and outlet device faceplates.

2.5 IDENTIFICATION LABELS

A. Provide labeling and signage for equipment as described herein and/or noted on the Drawings.

1. Equipment designations and headings: 1/4" height.
2. Secondary information: 3/16” height.

2.6 DIMMER RACKS

A. Basis of Design: Unison DRd power control system

B. General

1. Dimmer racks shall be dead front switch boards complete with all dimmers, control electronics, timers, circuit breakers, and wiring terminations. No external components shall be required.
2. Auxiliary racks shall be available to provide mounting of subcomponents including main circuit breakers, branch circuit breakers and control components.
3. Mounting: Floor mount, front access to allow back-to-back or side-by-side installation.
4. Electrical operation: 90 to 264 VAC 3 phase, 4 wire + ground, 47 to 63 Hz service.
5. Feed Size: Accept up to 400A per phase.
6. Power distribution: Copper buss bars. Aluminum buss bars are not acceptable.
7. Multiple rack bussing: As required, with optional equipment kit.
8. Listing and label: UL/cUL
9. Ventilation: forced filtered air using multiple low-noise fans providing redundancy in case of fan failure.
    a. Configure fans to turn on when control is energized.
    b. Maintain operating temperature of all components under full load when ambient temperature of dimmer room does not exceed 40°C/104°F.
    c. Fans shall remain on during thermal shutdown.
10. Provide racks configured to receive electrical services shown on electrical Drawings. Provide internal inter-rack bussing as required.
11. Provide terminals to accept feed and branch wire sizes shown on Drawings.
12. Fault current protection rating: 22,000 SCCR.
13. Key module spaces to accept only module amperage specified.
14. Module space circuit identification height: 1/4". Verify to match as-built conditions.
15. Dimmer bank signage: Permanently attached to equipment with following information:
    a. Project name
    b. Manufacturer name, toll-free service phone number, and job reference number
    c. "Designed by Stages Consultants" statement with phone number and web address
16. Dimmer rack section signage: Permanently attached to equipment with following information:

a. Performance venue name
b. Equipment designation
c. Feed size and source identification
d. Schedule of dimmer numbers listing use, circuit identification, dimmer type, and load; load information verified to match final as-built conditions

17. Mason Industries ND double deflection neoprene-in-shear type vibration isolation pads shall be provided for each dimmer rack. Neoprene shall be no harder than 50 durometer.

C. Electronics

1. Control electronics shall be microprocessor based, designed specifically for control of dimming systems.
2. Backlit, graphical LCD display shall access following information:

a. Rack setup
b. Rack status
c. Dimmer load
d. Temperature monitoring
e. Output voltage adjustment per dimmer module
f. System configuration
g. Operating parameters, presets, levels, fade times

3. Rack shall accept two DMX-512/1990 control signal inputs and one Category 5 or greater IEEE 802.3 Ethernet protocol control signals.
4. Opto-isolated contacted input shall be provided for panic system control.
5. Control modules shall directly support ANSI E1.31 (sACN) and ANSI E1.17 (ACN) network protocols. Control modules that do not support these protocols shall not be accepted.
6. Control signal input of each individual dimmer rack shall be fully opto-isolated from control signal input of any other rack, and fully opto-isolated from any control signal output.

2.7 DIMMER MODULES

A. SCR Dimmer Modules

1. Each module shall contain:

a. Circuit breakers

1) Fully magnetic
2) Trip current shall not be affected by ambient temperature
3) Rated for tungsten loads having an inrush of no less than 20 times normal current.
4) Switching duty application rating: 100%
5) Load rating: continuous operation at 100% load

b. Solid-state switching module

1) Encapsulated in high impact plastic cases
2) Isolation: 2,500 volts RMS between AC line and control lines

c. Toroidal filters

1) Reduce rate of current rise time.
2) Limit objectionable harmonics
3) Reduce lamp filament “sing”
4) Limit radio frequency interference on line and load conductors.

d. Power and control connectors

2. Key modules to prevent interchangeability of modules of differing capacity.
3. Module shall be capable of “hot patching” cold incandescent loads up to full rated capacity without malfunction with control signal at full.
4. Standard Rise Time Dimmers
    a. Dimmer shall have a rise time of not less than 500µs measured at 90 degrees conduction angle from 10% to 90% of output wave form with dimmer operating at maximum load. Voltage rate of rise (slew rate) must not exceed 300 mill volts per microsecond in any point of the wave under full load conditions.
5. High Rise Time Dimmers
    a. Dimmer shall have a rise time of not less than 800µs measured at 90 degrees conduction angle from 10% to 90% of output wave form with dimmer operating at maximum load. Voltage rate of rise (slew rate) must not exceed 210 mill volts per microsecond in any point of the wave under full load conditions.
6. Listing and label: UL/cUL

B. Non-Dim & Constant Modules

1. Non-dim modules shall utilize a latching type relay and have a full magnetic primary circuit breaker. Modules employing solid state relays shall not be acceptable.
2. Constant circuit modules shall distribute overcurrent protected power from the dimmer rack to non-dimmed loads. There shall be no moving parts other than the circuit breakers.
3. Module construction shall be similar in all respects to standard SCR dimmer modules above and shall be interchangeable with modules of the same rating.
4. Listing and label: UL/cUL

C. Electronic Low Voltage Modules

1. Each dimmer module shall use a solid-state relay (SSR) consisting of two MOSFET semi-conductors, and all required gating circuitry on the high-voltage side of an integral, opto-coupled control voltage isolator.
    a. Dimmers employing triac power devices, pulse transformers, or other isolating devices not providing at least 2,500V RMS isolation shall not be acceptable.
2. Power efficiency for ELV dimmers shall be at least 99 percent at full load with a no-load loss of 3V RMS.
3. Dimmer modules shall be available with current ratings of 10 amps (120 volts).
4. Module construction shall be similar in all respects to standard dimmer modules.
5. Circuit breakers shall be fully magnetic so the trip current is not affected by ambient temperature. Circuit breakers shall be rated for 100 percent switching duty applications.
6. Listing and label: UL/cUL.

D. Phase Adaptive Dimmer Module

1. Phase adaptive dimmer modules shall provide forward-phase or reverse-phase angle dimming specifically for LED replacement lamps.
2. Modules shall provide phase angle and min scale control.
3. Module shall contain transistor-based power devices, and all required gating circuitry on the high-voltage side of an integral, opto-coupled control voltage isolator.
    a. Dimmers employing triac power devices, pulse transformers, or other isolating devices not providing at least 3,000V RMS isolation shall not be acceptable.
4. The dimming engine shall have jitter reduction and dimmer curve smoothing software features.
5. Module construction shall be similar in all respects to standard dimmer modules.
6. Circuit breakers shall be fully magnetic so the trip current is not affected by ambient temperature. Circuit breakers shall be rated for 100 percent switching duty applications.

7. Listing and label: UL/cUL.

2.8 INTELLIGENT BREAKER PANELS

A. Basis of Design: Sensor IQ relay panel

B. General

1. Relay panel shall be dead front switch boards complete with all relays, control electronics, circuit breakers, and wiring terminations. No external components shall be required.
2. Mounting: Wall mount, surface or recessed.
3. Maximum Dimensions: 64” high x 20” wide x 5.25” deep.
4. Electrical operation: 120/208V 3 phase, 4 wire + ground.
5. Feed Size: Accept up to 400A per phase.
6. Listing and label: UL/cUL; UL508, UL67, UL924
7. Provide terminals to accept feed and branch wire sizes shown on Drawings.
8. Fault current protection rating: 65,000 SCCR.
9. Voltage Separation: Provide between high voltage and low voltage compartments.
10. Branch load circuit breakers shall be provided as required for branch load terminations.
    a. Listing and label: UL/cUL; UL489
    b. Integral mechanically held air gap relay
    c. Trip current shall not be affected by ambient temperature
    d. Rated for tungsten loads having an inrush of no less than 20 times normal current.
    e. Switching duty application rating: 100%
    f. Load rating: continuous operation at 100% load
    g. Rapid load switching: internal solenoid shall switch load when breaker at “on” position.
11. Branch circuit capacity: 48 poles, 15A to 30A one, two, and three-pole circuits as required.
12. Relay bank signage: Permanently attached to equipment with following information:
    a. Project name
    b. Manufacturer name, toll-free service phone number, and job reference number
    c. "Designed by Stages Consultants" statement with phone number and web address
13. Relay panel section signage: Permanently attached to equipment with following information:
    a. Performance venue name
    b. Equipment designation
    c. Feed size and source identification
    d. Schedule of relay numbers listing use, circuit identification, relay type, and load; load information verified to match final as-built conditions

C. Electronics

1. Control electronics shall be microprocessor based, designed specifically for control of dimming systems.
2. Backlit, graphical LCD display shall access following information:
    a. Breaker state
    b. Relay state
    c. Current draw
    d. Voltage
    e. Energy use over time
3. Rack shall accept DMX-512/1990 control signal input and one Category 5 or greater IEEE 802.3 Ethernet protocol control signals.

4. Opto-isolated contacted input shall be provided for panic system control.
5. Control modules shall directly support ANSI E1.31 sACN network protocol. Control modules that do not support these protocols shall not be accepted.
6. Control signal input of each individual dimmer rack shall be fully opto-isolated from control signal input of any other rack, and fully opto-isolated from any control signal output.

2.9 PANIC CONTROL SYSTEM

A. The panic control system shall instantly bring a programmable selection of dimmers and non-dim relays to full with the push of “Panic” button. Panic state shall be released with the push of “Normal” button.

B. The system shall always be enabled at every control location, regardless of the state of other control systems and independent of emergency power transfer relays.

C. Panic stations shall consist of the following:

1. Each panic control location shall consist of two EAO series 61 momentary pushbutton switches with requisite switching electronics.
2. Pushbutton momentary switches shall be illuminated, with colored lens engraved with button label.
3. One button shall be labeled “Normal” with green lens.
4. One button shall be labeled “Panic” with red lens and, hinged protective cover.

2.10 EMERGENCY LIGHTING TRANSFER SYSTEM

A. Basis of Design: ELTS2

B. General

1. Emergency lighting transfer system shall be mounted in NEMA 1 type enclosure with hinged locking door.
2. Enclosure Material: 14 gauge steel.
3. Mounting: Wall mount, front.
4. Maximum Dimensions (enclosure containing no more than 12 poles): 36” high x 24” wide x 9” deep.
5. Maximum Dimensions (enclosure containing no more than 24 poles): 48” high x 30” wide x 9” deep.
6. Electrical operation: 120/208V 3 phase, 4 wire + ground.
7. Feed Size: Accept up to 160A per phase.
8. Listing and label: UL/cUL
9. Provide terminals to accept feed and branch wire sizes shown on Drawings.
10. Fault current protection rating: 65,000 SCCR.
11. The emergency transfer system shall monitor three phases of the normal feed. Upon loss of power to one or more phases, normal system failure, or activation of the panic condition designated branch circuits shall be transferred from dimming system to second power source.
12. Transfer poles: Phase and neutral legs of each branch circuit load.
13. Transfer Switch Unit: Electrically-operated and mechanically-held.
14. Electrical operator: Single-solenoid mechanism, momentarily energized.
15. The switch shall be positively locked and unaffected by voltage variations or momentary outages such that constant contact pressure is maintained and temperature rise at contacts is minimized.
16. The transfer switch shall be rated to withstand the RMS symmetrical short circuit current without welding contacts.
17. Fire alarm interface: Isolated signal input shall automatically transfer loads to available secondary power source when facility fire alarm is activated.

18. Test Switch: Key-operated momentary switch for manual control.

C. Safety Standards: Comply with ANSI/UL1008, ANSI/NFPA 70, ANSI/NFPA 110.

D. Seismic Life-Safety Duty Applications: Comply with IBC-2000, -2003, -2006, -2009 and test all active and energized components to ICC AC-156.

E. Signage: Permanently attached to equipment with following information:

1. Performance venue name
2. Equipment designation
3. Feed size and source identification

2.11 EQUIPMENT RACKS

A. Basis of Design:

1. Middle Atlantic Products WR series for pull-out frame racks
2. Middle Atlantic Products DWR series for swing frame racks

B. General

1. Equipment rack shall be EIA compliant 19”, steel cabinet.
2. Color: Powder coat black
3. Rackrail Type: 10-32
4. Maximum Dimensions: 89” high x 24” wide x 33” deep.
5. Usable Depth: as required for specified equipment
6. Blank Filler Plates: Provide in un-used spaces. Internal space behind filler plates shall not be obstructed or used.
7. Panel Legends and Lines: Engraved and filled with engraver's enamel.
8. Provide non-combustible brackets, shelves, and other supports for heavy components and internal wiring assemblies and harnesses. Provide interior mounting angles to support work-writing tops and drawers.
9. Component Wiring: 36” long flexible cable harness to numbered barrier terminal block. Terminal block shall be attached to frames in line with associated panels and shall not interfere with adjacent components or filler panels.
10. Signage: Permanently attached to equipment with following information:

    a. Project name
    b. Performance venue name
    c. Equipment designation
    d. Feed size and source identification
    e. Manufacturer name, toll-free service phone number, and job reference number
    f. "Designed by Stages Consultants" statement with phone number and web address

2.12 HOUSE & WORK LIGHTING CONTROLS

A. Basis of Design: Unison Paradigm

B. General

1. Provide microprocessor based, solid state architectural control processor (ACP) that functions independently and in conjunction with lighting control console.
2. ACP shall be capable of controlling dimmer racks, relay panels, LED systems, automated lighting fixtures, and other device via DMX and ACN.
3. ACP functions:

    a. Station programming
    b. Macro sequencing
    c. Electronic lockout
    d. Room combine

e. Astronomical time clock events
f. Preset recall: 512
g. Fade time between presets
h. Rate of fade time modification
i. Concurrent preset recall

1) Multiple presets controlling the same attribute shall first interact based on priority and second based on latest takes precedence (LTP) or highest takes precedence (HTP) as configured.
2) A preset may be designated as an HTP override and shall cause HTP values to be discarded. It shall be possible to specify that a preset or attribute will persist when overridden.
3) When in use, the lighting control console shall override preset levels on a HTP basis. Where there are multiple external sources then priority and HTP shall be used to perform arbitration.

j. Record presets from lighting control console or other control sources on lighting system

4. Communication protocols:

a. DMX-512/1990
b. ANSI E1.31 (sACN)
c. ANSI E1.17 (ACN)
d. EIA-232 serial
e. Dry contact closure input and output
f. Network Time Protocol

5. Control channel capacity: 1,024 parameters

C. Master Stations

1. Master stations shall consist of backlit LED display

a. Minimum viewable display size: 7” WVGA
b. Minimum resolution: 800x480
c. Bezel: Aluminum
d. Touch interface: Capacitive with LED backlight
e. Viewing angle: 178° horizontal and vertical
f. Finish: Shown on drawings
g. Provide metal backbox and mounting frames

2. Connect to control system using category 5e or better wire.
3. Master stations shall provide control of lighting processor presets, sequences, fade times, macros, timeclock events, and interfaced external systems.
4. Master stations shall operate using graphic buttons, faders, and other images on programmable control pages. There shall at least 30 custom control pages available.
5. Graphic controls shall represent the active state of all presets, zones, and devices. Status indication shall be tracked across all stations in real-time, including tracking of fades on graphical fader controls.
6. Stations shall allow programming of multiple-level passcodes, page lockout, and visibility.
7. Control pages shall include:

a. House light presets (House Full, House Half, House Preset, House Out, Cleaning); work light presets (Pre-Show, Show, Post-Show, Rehearsal, Work, Off); system wide presets (Blackout, Night)
b. Performance lighting presets with snapshot record function
c. House light zone faders and House light master fader
d. Work light, run light, and non-dim zone control buttons
e. Lockout function to disable other stations and remote switches

f. Setup display for administrative functions

8. Page layout and interface functionality shall be determined by the Theatre Consultant following approval of shop drawings. Programming services shall be provided by the Manufacturer.

D. Entry Stations

1. Preset stations shall consist of programmable momentary pushbutton switches.

a. Finish: Shown on drawings
b. Provide flush or surface backbox

2. Pushbuttons shall provide control of a single channel, lighting processor preset, sequence, fade time, macro, timeclock event, and/or interfaced external system as required.
3. Preset Stations shall connect to control system using Manufacturer’s recommended wire type, network topology, and communication protocols.

2.13 SPARE PARTS

A. Furnish 10% spare parts for all perishable items such as pilot light lamps and fuses.

B. Furnish 2% spare parts for all low voltage and line voltage connectors, minimum of 2 per type.

C. Furnish the following additional spare parts:

1. (2) Spare dimmer and relay modules of each type listed in the Drawings
2. (1) Spare dimmer rack control electronics module
3. (1) Manufacturer’s Lighting Control Console spare parts package

PART 3 – EXECUTION

3.1 SUPERVISION OF INSTALLATION

A. Manufacturer shall provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary personnel for coordination meetings and site visits as requested by the Division 26 Contractor.

3.2 COMMISSIONING

A. Manufacturer shall provide the services of a qualified on-site engineering representative who shall perform the following:

1. Supervise and instruct equipment installer in all Manufacturer's requirements and specifications.
2. Prior to system energization, inspect the finished installation and confirm that the installation conforms to manufacturer’s requirements and specifications. Supervise correction of any deficiencies and retest deficient items.
3. Manufacturer's engineering representative shall be present during energization of the system.
4. In conjunction with the equipment installer, measure and adjust the full dimmer output voltage at each performance lighting receptacle. Typical voltage shall be uniform at each receptacle regardless of branch wiring length. Specific voltage requirements shall be determined by the Theatre Consultant or Electrical Engineer.
5. Verify operation of all control devices and network wiring.
6. Configure all hardware and software to a “show ready” state, including:

a. Network device addressing
b. Ethernet switches configured for industry standard control protocols

c. Dimmer and relay patch, dimmer curves, dimmer output voltage, control priority and similar variables
d. Panic preset and fade time
e. House light control zones, presets, sequences, fade times, macros, timeclock events, and interfaced external systems
f. Lighting control console patched 1 to 1 for all control channels in system
g. Console accessories such as remote video, tracking backup, and hand-held remote configured to operate with main lighting control console
h. DMX node/gateway patch, priority, and soft labeling
i. Lighting system computer software

B. Provide to the Architect and Theatre Consultant a written report confirming that the system has been properly installed and successfully energized within fourteen (14) days of energization.

3.3 DEMONSTRATION AND ACCEPTANCE

A. The Architect and Theatre Consultant (or their representatives) shall witness a full demonstration by the Manufacturer of each feature of each piece of equipment in the system. Comply with the following conditions:

1. The Manufacturer shall provide all necessary personnel and equipment, including lifts and ladders, to demonstrate fully the system's compliance to the specifications.
2. Contractor's project representative shall be present during testing as required.
3. Full and uninterrupted access to all areas shall be provided as necessary for complete testing and demonstration.
4. All loose equipment provided under this Section shall be on site and available for testing.
5. All architectural lighting fixtures circuited to the dimming system shall be installed and lamped.

B. Subject to satisfactory on-site demonstration, the Owner's representative shall accept the equipment on behalf of the Owner.

C. Should the demonstration prove unsatisfactory, the Theatre Consultant and the Architect shall inform the Manufacturer in writing, and the Manufacturer shall rectify the problems. Problems shall be rectified in the shortest time possible. During this period of remedial work, the Owner shall have beneficial use of the equipment. The Warranty period shall commence upon final acceptance by the Owner.

3.4 TRAINING

A. Provide a factory field service representative to offer instruction to the owner's staff in the proper operation and maintenance of the systems and software for at least 1 full day at a date and time convenient to the Owner.

END OF SECTION

SECTION 26 09 63 - PERFORMANCE LIGHTING SYSTEMS INSTALLATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work of this Section includes all labor, materials, equipment and services necessary to install the electrical work associated with the Performance Lighting Systems, as described in Section 260961 and shown on the Drawings.

B. Related sections include the following:

1. Performance Lighting Systems
2. Common Work Results for Electrical
3. Architectural Lighting Fixtures
4. Rigging Systems and Controls

1.3 QUALITY ASSURANCE AND STANDARDS

A. References to code, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies will refer to the latest edition of such publications adopted and published prior to submittal of the bid. All such codes and standards will be considered a part of this specification as if they were fully included herein.

B. Work and materials shall comply with the rules and recommendations of:

1. Prevailing national, state and local building codes.
2. UL, ETL, cUL, CSA and CE Labels – where materials and equipment are available under the continuing inspection and labeling service of applicable independent product testing and certification services, provide such labels, materials, and equipment.
3. National Fire Protection Associate (NFPA) Publication: National Electrical Code, NFPA70 as applicable to installation and construction of performance lighting and control equipment.
4. NEMA Compliance pertaining to components of performance lighting equipment.
5. United States Institute for Theatre Technology, Inc. (USITT) DMX512/1990 (ANSI E1.11-2004).
6. ANSI/PLASA Remote Device Management (ANSI/PLASA E1.20 RDM) and Architecture for Control Networks (ANSI E1.17-2006, E1.31) standards.
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE) 802.3af and 802.11n.

1.4 CERTIFICATIONS

A. The Contractor shall submit (as part of the Owner’s Manual) certificates from the manufacturer stating that the installed system is operating properly and complies with the manufacturer’s recommendations. This information shall be incorporated in the Owner’s Manual, as described in 260961

B. The Contractor shall submit a certificate that the Ethernet system has been tested and complies with all IEEE 802.3, ISO/IEC 8802-3 and PLASA standards. This information shall be incorporated as an appendix to the Owner’s Manual, as described in Theatrical Lighting Controls.

1.5 WARRANTY

A. In addition to the performance lighting controls manufacturer's warranty, provide warranty of the systems and equipment to be free of faulty workmanship or improper adjustment for a period of one year from the date of Owner's acceptance.

B. Replace items showing evidence of defective materials or workmanship within thirty days after notification. Make repairs without any cost to the Owner.

C. Resolve any conditions that might present a serious hazard to human life within 24 hours of notification by Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials as specified under Division 26.

PART 3 – EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Protect the equipment in this and Related Sections from damage and deterioration during all phases of the work, from the time of manufacture to the acceptance of the completed installation.

B. The Performance Lighting Systems equipment furnished under Section 260961 will become responsibility of the installer until Owner's final acceptance.

3.2 INSTALLATION

A. Install Performance Lighting Controls system as located on the drawings. Installation shall be in accordance with manufacturer's written instructions, recognized industry practice, and applicable requirements of the National Electrical Code and UL standards.

B. All load circuit conductors and data wiring for these systems shall be installed in metallic conduit, metal wireways, surface metal raceways, or other approved cable containment. Use of metal-sheathed or armored cable shall not be accepted without prior approval.

C. Voltage separation shall be maintained between line voltage, low voltage and data wiring.

D. All load circuit conductors shall be continuous from the dimmer room to the outlet devices or architectural fixture.

E. All dimmer rack load circuits must have individual neutral conductors. Neutral conductors must be routed directly adjacent to the live conductors of each circuit.

F. All data wiring shall be continuous from termination point to termination point; no splices or inline connectors shall be allowed.

G. Field terminations in these systems shall be as follows:

1. Main feed wires shall terminate in pressure lugs on buss bars.
2. Branch load wires shall terminate on screw terminals on barrier terminal blocks, circuit breakers and switches.
3. Control wires shall terminate on screw terminals on barrier terminal blocks and switches, or as noted.
4. Ethernet cables shall be installed and tested in compliance with all IEEE 802.3.ISO/IEC 8802-3 and ETSA standards.

H. Wire nuts and field soldered connections, except where noted, are not acceptable in these systems.

I. These systems shall be grounded, as shown on drawings and in accordance with applicable codes and regulations and/or at the advice of the Manufacturer.

J. Network Cabling

1. Performance Lighting System data cabling shown in Drawings to convey design intent only. Final quantities, types, and topologies shall be per the Manufacturer's approved shop drawings.
2. Provide Fiber Optic Cable as required for all runs greater than 90 meters (300') or as specifically shown in the Drawings.
    a. Confirm all cable routing distances to determine appropriate use of fiber runs.
    b. Cable shall be 62.5/125µm fiber optic cable as required to support network components.
    c. Cable shall exceed the IEEE802.3z Gigabit Ethernet Fiber specification for 62.5/125µm fiber.
    d. Cable shall exceed the TIA/EIA 568B Fiber specification.
3. Provide UTP Cable as required for all runs under 90 meters (300') unless specifically shown as Fiber Optic Cable in the Drawings.
    a. Copper cabling and connecting hardware shall fully comply with TIA/EIA 568B standards and with the standard installation of Category 5E products.

3.3 COMMISSIONING

A. Prior to energization of the system, perform the following tests and inspections following the instructions of the equipment Manufacturer's on-site engineering representative. Correct deficiencies and retest deficient items.

1. Inspect each outlet, faceplate, device and loose equipment for defects, finish failure, corrosion, physical damage, correct labeling, and nameplate.
2. Perform operational tests on mechanical parts and operable devices according to manufacturer's instructions or routine functional operation.
3. Check tightness of electrical connections with torque wrench calibrated within the previous six (6) months using Manufacturer's recommended torque values.
4. Perform continuity testing of each branch load circuit receptacle, determining correct polarity of wiring and correspondence between circuit numbers and labeling. Continuity Test Report shall be available upon request. Any problem(s), i.e. open circuit, short circuit, wrong termination, etc. shall be rectified in a timely manner and re-tested.
5. Test and certify Ethernet network for compliance with all IEEE 802.3, ISO/IEC 8802-3 and ANSI/PLASA standards. Network Compliance Test Report shall be available upon request. Any problem(s), i.e. cable length exceeding standards, open circuit, short circuit, wrong termination, etc. shall be rectified in a timely manner and re-tested. Submit final test report data and letter of certification for inclusion as an appendix to the Manufacturer's Instruction and Maintenance Manual.

B. Energization of the system shall only commence following written approval of the Manufacturer, and shall take place in the presence of the Manufacturer's on-site engineering representative.

C. In conjunction with the Manufacturer's engineering representative, measure and adjust the full dimmer output voltage at each performance lighting receptacle. Typical voltage shall be uniform at each receptacle regardless of branch wiring length. Specific voltage requirements shall be determined by the Theatre Consultant or Electrical Engineer.

3.4 DEMONSTRATION AND ACCEPTANCE

A. The Architect and its representative shall witness a full demonstration of each feature of each piece of equipment in the system.

1. Contractor shall provide all necessary personnel and equipment to demonstrate fully the system's compliance to the specifications.
2. Contractor's project representative shall be present during testing as required.
3. Full and uninterrupted access to all areas shall be provided as necessary for complete testing and demonstration.
4. All loose equipment provided under this and Related Sections shall be on site and available for testing.
5. All architectural lighting fixtures circuited to the dimming system shall be installed and lamped.

B. Subject to the on-site demonstration being satisfactory, the owner's representative shall accept the equipment on behalf of the Owner.

C. Should the demonstration prove unsatisfactory, the Theatre Consultant and the Architect will inform the Contractor in writing, and the Contractor shall rectify the problems. Problems should be rectified in the shortest time possible. During this period of remedial work, the Owner shall have beneficial use of the equipment. The Warranty period shall commence upon final acceptance by the Owner.

END OF SECTION

SECTION 26 09 73 – SOUND, VIDEO, & COMMUNICATION SYSTEMS INSTALLATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work of this Section includes all labor, materials, equipment and services necessary to install the following electrical work associated with the Sound, Video, & Communication Systems, as described in Section 274117 and shown on the Drawings:

1. A complete, pull-ready conduit system for installation of Sound, Video & Communication Systems wiring and devices, including, but not limited to:
    a. Conduit and raceways.
    b. Junction/pull boxes.
    c. Standard back boxes.
    d. Rack room terminal cabinets and “pull group” boxes.
    e. Fittings.
    f. Drag line (pull line)
    g. Electrical hardware, etc.
2. Installation of nonstandard back boxes for Sound, Video & Communication Systems devices provided under Division 27 (to be concurrent with other electrical work).
3. Electrical power service—including transformers, feeder cable, distribution panels, branch circuit panel-boards, and individual wall receptacles.
4. Sound, Video & Communication Systems “sound system” isolated ground AC power network.
    a. Inter-rack AC power wiring, shall be the responsibility of Division 27. Single-point termination to the racks shall be conducted on-site by Division 26.

B. Electrical service for the above work is shown on the E-series drawings

C. The SVC-series Contract Drawings provide block diagrams and equipment locations. The final design of the control systems is the responsibility of the respective Contractors, who will supervise the Electrical Contractor’s work.

END OF SECTION

SECTION 26 12 00 - MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Single and three phase individually mounted transformers and the transformer component of unit substation equipment operating at a voltage greater than 600 volts, for power and lighting applications. and medium-voltage transformers.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 05 00: Common Work Results for Electrical.
3. Section 26 05 13: Basic Electrical Materials and Methods.
4. Section 26 05 26: Grounding and Bonding.
5. Section 26 05 33: Raceways, Boxes, Fittings, and Supports.
6. Section 26 05 16: Medium Voltage Cables, Splices and Terminations.
7. Section 26 13 16: Medium-Voltage Metal-Enclosed Load Interrupter.

C. Codes and Applicable Standards: Transformers shall comply with all applicable IEEE, ANSI, and NEMA Standards for medium voltage Dry-Type Transformers including those with solid cast and/or resin-encapsulated windings.

1. Department of Energy Policy Act of 2005 - Public Law 109-58.
2. California Energy Commission Appliance Efficiency Regulations.
3. California Building Code.
4. ANSI/NFPA70, National Electrical Code, as adopted by the State of California.
5. IEEE C57.12.01, General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and Resin-Encapsulated Windings
6. ANSI C57.12.51, Requirements for Ventilated Dry-Type Power Transformers, 501 KVA and Larger, Three-Phase with High-Voltage 601 to 34 500 Volts, Low Voltage 208Y/120 to 4160 Volts
7. ANSI C57.12.55, Dry-Type Transformers in Unit Installations, Including Unit Substations - Conformance Standard
8. ANSI/IEEE C57.98, Impulse Tests, Guide for Transformer (Appendix to ANSI/IEEE C57.12.90)
9. IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers

10. IEEE C57.94, Recommended Practice for Installation, Application, Operation and Maintenance of Dry-Type General Purpose Distribution and Power Transformers

11. IEEE C57.96, Guide for Loading Dry-Type Distribution and Power Transformers

12. NEMA ST 20, Dry Type Transformers for General Applications

13. OSHA 29 CFR 1910.145 Specification for Accident Prevention Signs and Tags

D. ACRONYMS

ANSI	American National Standards Institute
OAR	Owner Authorized Representative
CEC	California Electrical Code
EOR	Engineer of Record
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include make, catalog number, dimensions, weight, KVA rating, percent impedance, finish, type, insulation class, design temperature and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating. Provide point to point connection diagrams and elevation details.

C. Provide manufacturer's data and inspection report that confirm compliance with the requirements of this section.

D. Provide a copy of the following test reports: Tests shall be performed on transformers, in accordance with IEEE C57.12.91. EOR shall review the reports for conformance with the specified criteria and applicable standards. Submit one copy for each set of shop drawings:

1. No-Load Losses.

2. Load Losses: Measurements shall be taken at multiple levels and plotted to show compliance with the specified criteria and applicable standards.

3. Turn Ratio.

4. Applied Potential (High-Pot).

5. Temperature Rise.

6. Induced Potential.

7. Sound Level.

8. Basic Impulse Insulation level (BIL).

9. Impedance.

10. Polarity and Phase Rotation.

11. Exciting Current.

12. Certified Test Report.

E. Installation Instructions: Submit manufacturer's complete package of printed installation instructions and connection diagrams.

1.03 WARRANTY

A. Transformers shall be warranted to be free from defects in materials, fabrication and execution for three years from date of substantial completion.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Transformers manufactured by Square D, Siemens, General Electric, PowerSmiths, MGM, and Cutler Hammer or equal.

B. Transformers shall be substation type with side-wall primary and secondary terminations.

C. Transformers shall be solid-cast, dry-type construction, mounted in a ventilated enclosure. There shall be no exposed screws, bolts, or other fastening devices that are externally removable.

D. There shall be no openings through which foreign objects such as sticks, rods, wires, or the like might contact live parts. Screen ventilated spaces from rodents and foreign objects. Provide means for padlocking compartment door(s). Padlocked locations shall be equipped with Corbin CAT 60 padlocks.

E. The average temperature rise of the transformer windings shall not exceed 80 degrees C when the transformer is operated at full nameplate rating. The transformer shall be capable of carrying 100 percent of the nameplate KVA rating in a 40 degrees C maximum, 30 degrees C average ambient as defined by IEEE C57.12.01.

F. Terminations shall be side-wall mounted for close-coupling to high and low voltage switchgear sections (Primary connection points shall have NEMA standard termination lug holes).

G. The transformer shall be rated as indicated on Drawings. The transformer shall be furnished with two 2 ½ percent full capacity above normal and two 2 ½ percent full capability below normal primary taps. Sound level shall not exceed the maximum specified by NEMA TR-1 for the applicable KVA size of the transformer.

H. Primary and secondary windings shall be constructed of copper conductors. Primary and secondary phase windings for each phase shall each be separately cast as one rigid tubular coil, and arranged coaxially. Each cast coil shall be fully reinforced with glass cloth, and cast under vacuum to provide complete, void-free resin impregnation throughout the entire insulation system.

I. The transformer core shall be constructed of high grade, grain-oriented silicone steel laminations, with high magnetic permeability. Magnetic flux density is to be kept well below the saturation point. The core shall be cruciform in shape, with mitered joints to keep core losses, excitation current and noise level at a minimum. The outside surfaces of the core shall be protected against corrosion by painting with a suitable coating after assembly. Core dipping is not permitted.

J. The enclosure shall be constructed of heavy-gage sheet steel, minimum 12-gage. Ventilating openings shall be in accordance with NEMA and CEC standards for ventilated enclosures. The cabinet shall be furnished with a minimum of four hinged doors. The cabinet shall be furnished with door sills for easy panel installation.

   a. Outdoor units shall be furnished with a NEMA 3R enclosure.

K. The base shall be constructed to permit rolling or skidding in any direction, and shall be furnished with jacking pads designed to be flush with the transformer enclosure.

L. Transformers shall be free of partial discharge up to at least 1.2 times the rated line to ground voltage. High voltage coils shall be subjected to a partial discharge test to verify its partial discharge.

M. Each transformer to be installed under this section shall be sound tested at the factory. Contractor shall provide two copies of transformers tests reports for EOR review.

   a. Transformers up to 35 KVA shall be less than 40 decibels. Transformers 36 KVA or more shall be a minimum of five decibels below NEMA standards per unit.

N. Transformers shall be provided with vibration dampers consisting of Korfund, Mason, or Caldynamics rubber pad and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

O. Transformers shall be UL listed.

P. Verify all points of connection with the manufacturer’s requirements, instructions, or recommendations prior to installation. Actual dimensions, weights, clearances and installation requirements shall be verified and coordinated prior to commencement of work.

Q. Provide and install OSHA/CAL OSHA mandated bilingual (English and Spanish) hazard warning signs on all accessible equipment sides containing access doors and/or panels. The signs shall be a minimum of 14 inch by 10 inch in size and be constructed on an aluminum backing. Design of signs shall be OSHA 29 CFR 1910.145 compliant with the words DANGER HIGH VOLTAGE KEEP OUT. Signs shall be attached to its intended mounting surface with a minimum if ten evenly distributed pop rivets for metal surfaces or tamper resistant screws on metal or other surfaces provided that protruding portion of screws if any is covered to eliminate the possibility of an injury.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Deliver, storage, protect and handle products in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

A. Transformer core frame shall be installed level on shock absorbing pads with enclosure.

B. Mounting bolts shall be extended into pads only and shall not be in direct contact with building structural members. Install transformer ventilation openings not closer than six inches from any wall surface. Installation shall comply with CBC seismic design requirements.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.

D. Transformers installed outdoors or below grade shall be installed on concrete pads as described under Section 03 3000: Cast-In-Place Concrete and as detailed in Drawings. Anchored bolts shall be tested to withstand 100 foot-pounds torque.

E. Install according to manufacturer's installation instructions.

3.03 VOLTAGE CHECK

A. Set taps on transformers as required providing satisfactory operating voltages with present loads energized, including new loads and any existing loads.

B. Provide instruments and accessories required to perform testing.

C. Follow manufacturer's instructions for checking output voltage and voltage tap changing.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

B. Repair scratched or marred surfaces affected during the execution of this work. Repaired surfaces shall match original finish.

C. Manufacturer to provide touch-up paint with delivery.

END OF SECTION

SECTION 26 13 16 - MEDIUM-VOLTAGE METAL-ENCLOSED LOAD INTERRUPTER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

Medium voltage load interrupter metal enclosed switchgear, single or multiple section line-ups.

B. Related Requirements:

1. Division 01 General Requirements.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 26 05 00: Common Work Results for Electrical.
4. Section 26 05 13: Basic Electrical Materials and Methods.
5. Section 26 05 16: Medium-Voltage Cables, Splices and Terminations.
6. Section 26 05 26: Grounding and Bonding.
7. Section 26 05 19: Low-Voltage Wires (600 Volt AC).
8. Section 26 10 00: Service Entrance.
9. Section 26 11 00 Load Center Unit Substations.
10. Section 26 12 00: Medium-Voltage Transformers.
11. Section 26 13 16: Medium-Voltage Metal-Enclosed Load Interrupter.
12. Section 26 24 13: Switchboards.
13. Section 31 23 13 Excavation, and Fill.

C. Related Standards:

1. ANSI C37.57 – Metal-Enclosed Interrupter Switchgear Assemblies - Conformance Testing.
2. ANSI C37.58 – Indoor AC Medium-Voltage Switches for Use in Metal-Enclosed Switchgear - Conformance Test Procedures.
3. ANSI C37.20.3 – Standard for Metal-Enclosed Interrupter Switchgear (1 kV–38 kV).
4. IEEE-ANSI C37.22 – Preferred Ratings and Related Required Capabilities for Indoor AC Medium-Voltage Switches Used in Metal-Enclosed Switchgear.

5. IEEE 551 – Recommended Practice for Calculating AC Short-Circuit Currents in Industrial and Commercial Power Systems.

6. IEEE 1584 – Performing Arc-Flash Hazard Calculations.

7. IEEE 3002 – Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

8. NEMA SG5 – Power Switchgear Assemblies

9. NEMA SG6 – Power Switching Equipment.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. List of Materials: Submit a complete list of proposed materials.

C. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of ancillary components fitting suspension and fastening section(s) in place. Provide wiring diagrams for power distribution and connections.

1. Include a front elevation indicating dimensions and locations of equipment, make, kind and size or capacity of equipment and bussing, barriers, nameplate inscriptions, finish, total weight and size, and locations and sizes of anchor bolts.

D. Prior to start of construction; provide copies of required test reports, proof of UL listing and compliance with IEEE and ANSI applicable industry standards.

E. Installation Instructions: Submit manufacturer's written installation instructions including recommendations for handling, protection, and storage of equipment.

F. Submit Fault Current, Coordination, and Arc-Flash reports based on installed conditions and equipment.

1.03 SUBSTITUTIONS

A. Material and products substations that deviate from these requirements shall not be accepted without written approval from OWNER'S Design Standards Section and Maintenance and Operations Technical Unit. When deviating or substituting equipment, the CONTRACTOR shall submit a substitution request form that states reasons for the request and benefits to OWNER; as well as compliance with all applicable codes and industry standards.

1.04 QUALITY ASSURANCE

A. Equipment shall be tested and approved in accordance with applicable industry standards including those listed under article 1.02.

B. Provide copies of equipment tests for metal-enclosed interrupter switchgear (ANSI), and NEMA SG6 power switching equipment.

C. Equipment shall comply with California Electrical Code.

D. CONTRACTOR shall submit proof that personnel working in the installation are properly trained and certified for working/ installing medium voltage power distribution equipment.

E. Two weeks prior to final inspection, submit the following:

1. Certification by the manufacturer that installed equipment conforms to the requirements of the drawings and specifications.

2. Certification by the CONTRACTOR that equipment has been properly installed, adjusted, and tested.

1.05 WARRANTY

A. Provide the following warranties:

1. Manufacturer shall provide five-years material warranty.

2. CONTRACTOR shall provide two-years installation warranty.

PART 2 - PRODUCTS

2.01 LOAD INTERRUPTER SWITCHGEAR

A. Switches shall be quick-make, quick-break, three-pole, two-position with a stored energy spring mechanism to provide quick switch operation independent of the handle speed. A viewing window shall be installed in switch enclosure and located to enable visible inspection of switch poles from outside enclosure.

B. Complete metal enclosed switchgear shall be rated as indicated on Drawings with fault close; momentary ratings capable of withstanding short-circuit stresses.

C. High-voltage fuses and non-disconnecting fuse mountings shall be accessible only through a separate door mechanically interlocked with load break switch, to insure the switch is in open position when fuses are accessible. A key interlocking system shall also be provided to prevent fuse access door from being opened unless switch is open, and to prevent switch from being closed unless fuse access door is closed. Switch designs with full height fuse access doors shall have a solid barrier covering area of main cross bus and/or line side of switch. Metal screen barriers are not permitted. Energized parts shall not be within normal reach of opened doorway. Four single full-length inter-phase barriers shall isolate three phases of the switch from each other and from enclosures. Fuses shall be current limiting type of self-contained design to limit available fault current stresses on system. Fuses shall be affixed in position with provisions for removal and replacement from front of gear without use of special tools. Provisions for padlocking in open and closed position shall be provided.

D. Utility company metering section shall be furnished with mounting and wiring instrument transformers and meters, as required by the serving utility company.

E. Enclosure frame and internal barriers shall be fabricated of code gage and finished with two coats of medium gray, ANSI No. 451, paint applied over a rust-inhibiting phosphate primer.

F. Power Distribution System Reports: The required reports shall be performed using an industry standards software such as SKM System Analysis Inc., ETAP Powering Success, EasyPower, or District approved equal. The following information must be submitted:

1. CONTRACTOR shall provide a complete selective coordination report of the installed power distribution system breakers and disconnects in compliance with applicable codes and IEEE standard.

2. CONTRACTOR shall provide an Arc-Flash study report in accordance to code and applicable IEEE standards. The report shall indicate trip times for protective device(s) settings, arcing fault current values, and incident energy and flash boundaries. Report shall indicate clothing requirements for each piece of equipment.

3. CONTRACTOR shall provide a Short Circuit Report of the installed power distribution system in compliance with codes and applicable IEEE Standards.

2.02 SWITCHGEAR CONSTRUCTION

A. Switch bays shall be separately constructed cubicles assembled to form rigid freestanding units. Adjacent bays shall be securely bolted together to form an integrated rigid structure. Top and rear covers shall be removable. Individual units shall be braced to prevent distortion. Installation shall adhere to seismic requirements of CBC.

B. Provisions shall be furnished to allow for convenient extension of both main bus and ground bus to adjacent bays, which may be added in future. Main crossover bus is to be furnished and supported from top of enclosure on NEMA glass insulators. Ground bus shall run continuously through entire line-up and shall be securely fastened to the steel frame of each bay.

C. Metal enclosed gear shall be fully assembled and tested at factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of installation at the Project site.

D. Outdoor units shall be furnished in NEMA 3R enclosures designed with sloped drip-proof roofs. Cubicles shall be provided with door-in-door construction. Outer doors shall open to normal switch doors and operating handles. Switch-operating handles shall not be exposed to weather and will be operable regardless of weather conditions. Provide the front with a bulkhead type door along with three-point latch and vault type handle with provisions for padlocking. Cubicles are to be designed to allow front and rear access and do not require routing of line side or load side connections in front of switch/fuse compartment. Padlocks shall be provided for doors and keyed to Corbin No. 60 keys.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cable terminations shall be as indicated in Section 26 05 16 - Medium-Voltage Cables, Splices, and Terminations.

B. Furnish Spare Fuses: One spare fuse shall be furnished for each fusible switch installed. Spare fuse shall be of type and rating as those installed.

C. Where free-standing equipment is installed at exterior locations or in locations below grade, concrete pads shall be provided as described under Section 03 3000: Cast-In-Place Concrete. Anchor bolts for freestanding equipment shall be designed to meet code seismic requirements. Equipment shall be anchored to new slabs with four ½ inch by 3 ½-inch expansion bolts per section; ½ inch anchored bolts shall be tested to withstand 100 foot-pounds of torque (Switchgear must be installed “Level” to ensure all doors open and close without being forced).

D. Follow manufacturer's instructions for receiving, handling, storage and installation of switchgears.

E. Provide two sets of manufacture’s recommended service and maintenance documents.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This specification covers single-phase and three-phase general purpose individually mounted dry-type transformers, 600 V maximum, for power and lighting applications. It includes transformers as specified and as indicated on Drawings.

B. Work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

C. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 05 00: Common Work Results for Electrical.
3. Section 26 05 13: Basic Electrical Materials and Methods.
4. Section 26 05 26: Grounding and Bonding.
5. Section 26 05 19: Low-Voltage Wires (600 Volts AC)
6. Section 26 05 33: Raceways and Boxes, Fittings and Supports.
7. Section 26 08 00: Electrical Systems Commissioning.
8. Section 26 26 00: Power Distribution Units.
9. Division 27: Communications.

D. Codes and Applicable standards: Products and installation shall meet or exceed the latest edition of the following standards.

1. ANSI/IEEE C57.96, Distribution and Power Transformers, Guide for Loading Dry-Type Transformers; Appendix to ANSI C57.12 Standards.
2. Department of Energy, Energy Act of 2005.
3. International Electrical Code adopted by the State of California.
4. ANSI/NEMA 250 Enclosure for Electrical Equipment (1000 Volts Maximum).
5. IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.

6. IEEE C57.110 – IEEE Recommended Practice for establishing liquid-filled and dry-type power and distribution transformer capability when supplying nonsinusoidal load currents.

7. 1100-IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

8. NEMA standard 20, Dry-Type Transformers for General applications.

9. UL 506, Specialty Transformers.

10. UL 1561, Dry-Type General Purpose and Power Transformers.

11. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.

12. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

13. NEMA TP-3, Standard for the Labeling of Distribution Transformer Efficiency.

14. CSA 802.2-00 Minimum Efficiency Values for Dry Type Transformers

15. California Building Code (CBC)

16. Tri-axial shake test results conducted in accordance with AC156 test protocol.

17. California Electric Code

E. No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Owner Authorized Representative by the CONTRACTOR.

F. ACRONYMS

ANSI	American National Standards Institute
AOR	Architect of Record
CEC	California Electrical Code
EOR	Engineer of Record
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code

NEMA National Electrical manufacturers Association

1.02 DESIGN REQUIREMENTS

A. Premium Efficiency transformers with internal losses at 35 percent loading reduced by 30 percent when using temperature and material correction factor to 75 degrees C per NEMA Standard TP1

B. Load Mix: Transformer shall be UL 1561 listed to feed a mix of equipment load profiles such as computer without detracting or significant degradation of efficiency.

C. The transformer shall be labeled with a K-13 Rating in accordance with UL 1561 35.21 and 34.2.

D. Transformer shall be certified as required by the California Energy Commission, Title 20 – Appliance Efficiency Regulations, unless otherwise EXEMPT under 110.10(a).

E. Construction: Windings shall be continuous wound copper with brazed or welded terminations.

1. Insulation and Varnish Systems: Epoxy Polyester impregnation

2. Terminals, including those for changing taps must be readily accessible by removing a front cover plate.

F. Performance of transformers shall meet or exceed the requirements of applicable codes and standards, the DOE Energy Policy Act of 2005 - Public Law 109-58 and the latest requirements of the California Energy Commission Appliance Efficiency Regulations. In addition; transformers shall be designed to an efficiency standard higher than the lowest legal standard for the purpose of contributing to LEED Energy and Atmosphere (Optimized Energy Performance) and Utility Rebates.

G. Transformers shall be self-cooled type with 220 degrees C. insulation and a maximum temperature rise of 130 degrees C. under continuous full load conditions with an ambient of 40 degrees C.

H. Transformers shall be furnished with four 2.50 percent (two above and two below normal voltage) taps. Windings shall be of fire-resistant type, designed for natural convection cooling through normal air circulation.

I. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, installation, and short circuit stresses.

J. Enclosure cover plates shall be sheet steel, captive bolted to enclosure framework. Enclosure shall provide suitable ventilating openings with rodent-proof screens, NEMA 1 enclosure. Enclosure shall be provided with lifting lugs and jacking plates as required. Transformers installed outdoors shall be provided with weatherproof NEMA 3R enclosure and weatherproof kit.

1. Submit rodent-proof screen sample for OWNER's approval.

K. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, excepting cores and core mounting frames shall be furnished clean, rust-proofed, and provided with a coat of an inert primer.

L. Transformers up to 35 KVA shall not exceed 40 decibels. Transformers 36 KVA or more shall be a minimum of 5 decibels below NEMA standards per unit. Transformers shall be provided with vibration dampers consisting of California Dynamic, Mason Industries, Korfund or equal neoprene mounting pad and Elastorib sheeting. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.

M. Transformers shall be UL listed.

N. Each transformer to be installed under this section shall be sound tested at the factory. CONTRACTOR shall provide two copies of transformers tests reports for EOR's review.

O. Equipment shown on drawings to scale is approximate only and based upon a general class of equipment specified. The CONTRACTOR shall verify dimensions and clearances prior to commencement of work.

P. Verify points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. Actual dimensions, weights, clearances and installation requirements shall be verified and coordinated by the CONTRACTOR.

Q. K-rated transformers shall be type NL-UL.

1. Electrostatic shield.

2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.

3. Double-size neutral terminal.

4. Additional coil capacity to compensate for higher non-linear load loss.

5. Heavy gage ventilated indoor enclosures (provide weather shields where installed indoors).

6. K-rated transformers shall meet other requirements of this section.

R. NLP-UL for projects where the non-linear loads as indicated on drawings and be equipped with the following features:

1. Electrostatic shield.

2. NLP series shall have a maximum sound level of 3 dB below NEMA standards.

3. Double-size neutral terminal.

4. Additional coil capacity to compensate for higher non-linear load loss.

5. Heavy gage ventilated indoor enclosures (provide weather shields where installed indoors).

6. K-rated transformers shall meet other requirements of this section.

1.03 SUBMITTALS

A. Provide submittals in accordance with Division 01.

B. Shop Drawings: Include make, catalog number, dimensions, weight, KVA Rating, Percent Impedance, finish, type, insulation class, design temperature, sound levels, efficiency and taps provided. Include regulation at 80 percent and 100 percent of full load, no-load loss, full-load loss, percent efficiency, percent impedance, noise level and continuous capacity rating.

C. Provide manufacturers data and inspection report that confirms transformers compliance with UL 1561, DOE, and NL-UL or NLP-UL (Refer to 1.02.Q).

D. Provide a connection schematic diagram.

E. Provide the following tests reports: Project Inspector will review the reports for conformance with specified criteria, and compliance with the applicable standards. Submit one copy for each set of shop drawings being submitted.

1. Load Losses: Measurements shall be taken at multiple load levels and plotted to show compliance with specifications and correlated to efficiency curve for the transformer size and type.

2. Provide No-Load and Total Losses report.

3. Applied Voltage.

4. Temperature Rise.

5. Induced Voltage.

6. Sound Level.

7. Impulse Test.

8. Manufacturer’s nonlinear load test representing real world load mix. Transformers not meeting this requirement shall not be installed.

F. Submit harmonics test plan as follows:

1. NEMA ST-20.

a. Open Circuit Test (no load losses):

1) Use for both Linear and non-Linear.

2) Measure Power.

b. Short Circuit Test (load losses):

1) Short Primary Winding: Linear Test complete with linear profile through secondary winding.

c. Non-Linear Test.

1) Complete with non-linear profile through secondary windings.

2) Measure Power.

d. Provide data and graph efficiency:

1) Graph-1 – Linear Loads 0 to 100 Percent Loads.

2) Graph 2 – Non-Linear Profile K-13 0 to 100 Percent loads.

2. Test Plans measuring Power In and Power Out will not be accepted since procedures are not covered by any standard.

1.04 SUBSTITUTIONS

A. Transformers that deviate from these requirements shall not be accepted without written approval from OWNER'S Design Standards and Maintenance and Operations Technical Units. When deviating or proposing substitutions the following information shall be submitted:

1. Substitution request form substantiating reasons for the deviation and benefits to the OWNER.

2. Proposed substitutions requests shall provide proof of compliance with transformers characteristics indicated in this specifications section.

B. Submittals must comply with contract general provisions.

1.05 QUALITY ASSURANCE

A. Installation shall be performed by State approved/ certified electricians.

B. Transformers shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL), and in compliance with applicable industry standards and codes, including those mentioned under REFERENCES.

C. Provide labor, engineering, design, testing, supervision, material and equipment required.

D. Equipment shall be new and high quality. Manufacturer shall have been continuously manufacturing distribution transformers for at least 10 years.

1.06 COMMISSIONING

A. A Commissioning Services Provider (CxSP) retained by the OWNER will lead and provide Commissioning (Cx) of power distribution systems and assemblies, including submittal review, installation, testing, documentation, and training as indicated in section 26 08 00 – Electrical Systems Commissioning.

B. CONTRACTOR shall follow the commissioning responsibilities stated in Section 01 91 13, General Commissioning Requirements.

C. CONTRACTOR shall provide all tools and personnel, and perform start-up, prefunctional and functional performance testing in the presence of the OWNER's Commissioning Services Provider.

1.07 WARRANTY

A. Provide a one-year labor warranty.

B. Transformers shall be warranted to be free from defects in materials and fabrication for a period of three years from the date of substantial completion.

C. Warranty period begins at project acceptance for beneficial occupancy.

D. Warranty exclusions for third party components is not acceptable.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Transformers manufactures Siemens, Square D, General Electric, PowerSmiths, MGM, Cutler Hammer, or equal approved by OWNER.

B. There shall be no openings through which foreign objects such as sticks, rods, wires, or the like might enter and contact live parts. Provide means for padlocking compartment doors.

1. Connection terminal points shall be bottom fed and located as far as possible below vent openings, or below top connections.

2. Terminals shall be protected from external/foreign objects contact.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Deliver, storage, protect and handle products in accordance with the manufacturer's recommendations.

3.02 INSTALLATION

A. Transformer core frame shall be installed level on shock absorbing pads within enclosure. Comply with seismic requirements of CBC.

B. Mounting bolts on floor mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.

C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts where required.

D. Transformers installed outdoors or below grade shall be mounted on concrete pads as specified in Section 03 30 00: Cast-In-Place Concrete.

E. Install transformer ventilation openings not closer than 6 inches from wall surfaces.

F. Do not install transformers in corrosive environments such as swimming pool pump and boiler rooms, or similar areas.

3.03 VOLTAGE CHECK

A. Set taps on transformers to provide satisfactory operating voltages with present loads energized, including new loads and existing loads. A check shall be performed in the presence of the Project Inspector at a panel fed from each transformer, which is farthest from transformer. Voltages at transformers ranging from 118 to 122 volts inclusive, for 120-volt systems and proportionately equivalent for higher voltage systems are permitted.

B. Provide instruments and accessories required to perform checks. Voltmeters shall be accurate within .075 percent or one percent and shall have scales permitting voltage readings to be performed on upper half of scale. Calibration of the meters shall be observed by the Project Inspector.

C. Adjust transformer taps under full load operating conditions, to provide normal operating voltages at the loads.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

B. Repair scratched or marred surfaces affected during the execution of work. Repair surfaces shall match original finish.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Main switchboard, including metering facilities required by the utility company.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 26 05 00: Common Work Results for Electrical.
4. Section 26 05 13: Basic Electrical Materials and Methods.
5. Section 26 05 26: Grounding and Bonding.
6. Section 26 05 19: Low-Voltage Wires (600 Volt AC).
7. Division 27: Communications.
8. Division 28: Electronic Safety and Security.

C. Related Industry Standards: The most current version of the following industry standards.

1. ANSI/NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
2. California Electrical Code (CEC).
3. IEEE C57.12.28 – Standard for Pad-Mounted equipment Enclosure Integrity.
4. IEEE 551 - Recommended Practice for Calculating AC Short-Circuit Currents in Industrial and Commercial Power Systems.
5. IEEE 1584 – Performing Arc-Flash Hazard Calculations.
6. UL/ANSI 891 – Standard for Safety Switchboards.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings:

1. Include a front elevation indicating dimensions and locations of equipment on switchboard, make, kind and size or capacity of equipment and bussing, location of each service conduit entering switchboard, barriers, nameplate inscriptions, finish, total weight and size of switchboard and locations and sizes of anchor bolts.

C. Fault Current, Coordination and Arc-Flash Reports: the following reports shall be prepared using SKM Systems Analysis, ETAP Powering Success, EasyPower, or equal.

1. Provide a short-circuit and coordination report signed and stamp by a registered electrical engineer. Studies shall be in accordance with applicable IEEE guidelines. Submit two copies of each study for review prior to ordering and installing equipment.

2. Provide a system coordination report for main and branch circuit protective devices including transformers secondary protective devices. Study shall be recorded on log paper. The circuit protective devices shall be set based on the coordination study. A final written record of protective device settings shall be submitted.

3. Provide a complete arch-flash report based on installed equipment, and feeders' sizes and lengths. Prepare the report in accordance with code requirements and IEEE 1584 standard. The report shall indicate trip times for protective device(s) settings, arcing fault current values, and incident energy and flash boundaries. The arc-flash report shall indicate clothing requirements for each piece of equipment.

4. Provide installation detail and seismic anchorage notes for switchboards.

PART 2 - PRODUCTS

2.01 SWITCHBOARDS

A. General Description: Switchboards shall be product of W.A. Benjamin Electric, Cuttler Hammer, General Electric, Siemens, or equal, and shall conform to the following requirements:

1. Complete assembly, including steel framing and covers, bus system, and breaker mounting, shall satisfy applicable provisions of UL 891 and NEMA PB-2 and the California Electrical Code for low-voltage distribution switchboards. Switchboards shall be furnished with UL labels.

2. Switchboards shall be floor standing, dead front, dead rear, line bussed, front operated and connected, circuit-breaker type, unless otherwise indicated and shall contain equipment indicated and specified. Switchboard shall be complete with pull, service, and distribution sections as required.

3. Required equipment shall be enclosed in fully interchangeable die formed steel sectional cabinets with top and bottom plates and required braces and gussets so that cabinets will be absolutely rigid, plumb and uniform in size. Each cabinet shall be a separate and independent unit with assembly holes die-stamped or jig drilled;

openings for interconnections shall be so placed that cabinet can be located in any position in assembly without drilling or cutting holes on job. Deliver switchboard to Project site in completely assembled sections and provide required assembly bolts and blanking plates. Front plates and doors shall be of not less than 12 gage furniture steel, completely removable, secured to cabinet with machine screws, with cup washers uniformly and symmetrically spaced. Provide hinged wire gutter covers for distribution sections. Equipment shall meet NEMA and UL standards.

4. Main circuit breaker or main fusible switch shall be as follows:

   a. Main circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic with solid state trips, bolted to bus with frame size and trip ratings as indicated on drawings. Voltage, amperage ratings and number of poles shall be as indicated on breakers. Main breaker shall provide a minimum short-circuit interrupting capacity as determined by utility company. Provide shunt-trip and integral ground fault devices, as indicated on drawings. Breakers shall be furnished with lockout provisions.

   b. Main fusible switch 800 amps or larger ampacity shall be high pressure contact, stored energy, quick-make/quick-break operation, with current limiting fuses, as indicated on Drawings. Provide shunt-trip, and integral ground fault devices, as indicated on Drawings. Were required, switches shall be motor operated and be furnished with an electrical trip mechanism piloted by output of ground fault sensing circuitry. Switch shall be furnished with lockout provisions.

5. Feeder circuit breakers shall be automatic, one-piece molded-case, trip-free, common trip, quick-make, quick-break, thermal-magnetic or solid-state type bolted to bus, with handles clearly indicating tripped position. Breakers shall be furnished with a single handle with no tie-bar. Voltage, amperage, and number of poles shall be as indicated on Drawings. Breaker ratings shall be on handle or label. Breakers shall be furnished with lockout provisions approved by the State of California for padlocking and shall provide a minimum symmetrical short-circuit interrupting rating, as indicated on Drawings. Series rated circuit breaker combinations are not acceptable.

6. Fusible feeder switches shall be quick-make, quick-break, voltage rating and number of poles as indicated on Drawings, with visible blades and dual horsepower ratings. Switch handles shall physically indicate on and off positions. Switches shall be lockable only in off position and accept three industrial type heavy-duty padlocks. Switch covers and handles shall be interlocked to prevent opening in on position. Provide means to permit authorized personnel to release interlock for inspection purposes. Switches shall be equipped with Class R current limiting fuses or dual element fuse of size and capacity indicated on Drawings.

7. Utility metering provisions shall meet requirements of serving utility and shall be furnished with necessary fittings.

8. Provide switchboard silver-plated copper bus bars of same capacity as main breaker, or as indicated on Drawings, between current transformer and main section and distribution sections; also, full height of breaker space in distribution portions. Copper bus shall have current density of 1000A per square inch of cross section. Bus structure shall be free-fitted and shall have sufficient strength to withstand short-circuit as indicated on drawings. Connections shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices. Bus bar bracing shall be designed to withstand maximum available short-circuit current. Connections for cables to circuit breakers, switches and motor control devices shall be heavy-duty mechanical pressure type terminal lugs. Provide service cable lugs as required by utility company. Cables and internal wiring shall be supported with suitable cleats.

9. Switchboard distribution sections shall be furnished with full height bussing. Unused spaces shall be provided with blank covers. Switchboards, as complete units, shall be given single short-circuit current ratings by manufacturer. Such ratings shall be established by actual tests by manufacturer, in accordance with UL specifications, on equipment constructed similarly to the furnished switchboard.

10. Provide a large nameplate identifying switchboard, indicating service voltage, originating power source, function and current rating. Nameplate shall be furnished with 3/16-inch engraved black letters on white background. Name plate shall be mechanically fastened to switchboard.

11. Provide labels for circuit breakers, disconnect switches, and or other disconnecting means in switchboards. Labels shall be a P-Touch type or equal, with a minimum width of 3/8 inch with black letters on white background. Label shall indicate name of load served, name or room number and if in different building, name of building. If equipment is installed in same room as source, label should indicate source name and “in this room”.

12. Paint cabinets, framework and plates inside and out with one coat of rust-resistant metal primer and one coat of gray enamel, baked on, or lacquer sprayed on.

13. Manufacture boards according to reviewed Shop Drawings. Switchboard shall meet requirements of legally constituted authorities having jurisdiction, and respective serving utility.

14. Switchboards installed outdoors shall be weatherproof NEMA Type 3R enclosure. Enclosure construction shall be formed of code gage galvanized steel with ANSI No. 61 gray enamel finish. Heavy-duty, three-point latching, vault type door handles with padlocking provisions shall be furnished on doors. Padlocks shall be furnished keyed to Corbin No. 60 keys. Switchboards installed outdoors shall be specifically required to maintain service during extreme outdoor ambient temperatures of a minimum of 150 degrees Fahrenheit in NEMA Type 3R enclosures.

15. For grounded wye electrical service switchboards rated more than 150 volts, to ground and 1,000 amperes or more, provide ground fault protection for main protective device. Ground fault protection shall be UL listed, with ground sensor encircling phase conductors and neutral conductors integral with the main protective device. Provide testing of ground fault protection system by an independent recognized testing laboratory. Testing lab shall provide necessary testing equipment at the Project site and perform a certified test on ground protection system in presence of the Project Inspector. The ground fault setting shall be selected to coordinate with downstream circuit protective devices. Verify that the system neutral is grounded at the service entrance switchboard only, except neutrals of step-down distribution transformers. For branch circuit protective devices, rated 800 amps or more, provide ground fault protection where shown on the drawings, or as described above, for main protective device. Coordinate settings with main protective device ground fault protection.

16. In main and distribution switchboards provide a multifunctional digital meter with true RMS measured Amperes (each phase and neutral) Volts (line-to-line and line-to-neutral), Power Factor, Frequency, VA, VAR, Watts, KWH, KVARH, KVAH, voltage/current unbalance, and demand metering: W, VAR, Amperes, VA. Meter to have a front mounted RS232 port to allow programming and meter values via laptop computer and supplied software. The meter shall be GE Multiline PQM with BACnet translator capabilities; equal or better meters will be acceptable with District's approval only. Contractor shall supply the metering software and electronic key to owner.

17. Connections to bussing shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Switchboards shall be located so that they are readily accessible and not exposed to physical damage.

D. Switchboard locations shall provide sufficient working space around the switchboard to comply with the California Electrical Code.

E. Switchboards shall be securely fastened to the mounting surface.

F. Switchboard cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

H. Lugs shall be suitable and as required for installation with the conductor being connected.

I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

J. Maintain the required bending radius of conductors inside the cabinet.

K. Distribute and arrange conductors neatly in the wiring gutters.

L. Tightening the wire lugs or conductor connections shall be performed in the presence of the Project Inspector. Torque values shall be those recommended by manufacturer.

M. Remove shipping blocks from component devices.

N. Manually exercise circuit breakers to verify they operate freely.

O. Remove debris from switchboard interior.

P. Follow manufacturer's instructions for installation.

Q. Furnish one spare fuse for each fusible switch installed. Spare fuses shall be of the same type and rated as those installed.

R. Do not install in highly corrosive environments such as pool equipment, boiler, chemical and corrosive materials storage rooms, and similar areas. When equipment is installed in such areas, it shall be labeled and listed for the application.

S. Switchboard equipment and system components shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of bolted electrical connections, and perform insulation resistance tests on each bus section, phase-to-phase and phase-to-ground for one minute in accordance with requirements stated in NETA-ATS 2007 table 100.1. Test shall be performed in the following manner:

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of bussing, circuit breakers and/or fused switches. The fused switches shall be equipped with fuses or temporary jumpers in place of fuses. Breaker and fused switches shall be tested in the closed position. No wiring shall be connected to the line or load side of the switchgear during testing.

    a. Provide calibration program records to assure the testing instruments to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

    b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

    c. Test reports shall include the following:

1) Identification of the testing organization.

2) Equipment identification.

3) Ambient conditions.

4) Identification of the testing technician.

5) Summary of project.

6) Description of equipment being tested.

7) Description of tests.

8) Test results.

9) Analysis, interpretation and recommendations.

1. Perform tests in the presence of the Project Inspector.

2. During testing, provisions shall be made to prevent damage to solid state components, or electronic equipment such as TVSS equipment that may be tied onto switchboard bussing.

3. Test results shall meet manufacturer's recommendations or NETA ATS- 2007 recommendations, whichever is more stringent.

3.02 PADS AND ANCHORING

A. Where free-standing equipment is installed at exterior locations or in locations below grade, concrete pads shall be provided as specified in Section 03 3000: Cast-In-Place Concrete.

B. Where a utility meter is installed in a switchboard, concrete pad shall extend three feet from face of switchboard door or board, whichever is greater. Concrete pad installation shall comply with electric utility company requirements.

C. Anchor bolts for freestanding equipment shall meet CBC Seismic design requirements, and manufacturer's installation recommendations. The more stringent requirements will be enforced.

D. Project Record Documents: Provide project record drawings of switchboards as installed, indicating main and branch circuit ratings, circuit numbers and part numbers.

E. For ground fault relays and sensors, the following information shall be provided:

1. Certified Calibration and Acceptance Test.

2. Installation Instructions.

3. Operating Instructions.

4. Maintenance Instructions.

5. Replacement Parts List.

6. Final Test Report.

F. Test information shall be submitted to the Architect. Nameplates may be fabricated of engraved laminated plastic or etched metal and shall be permanently attached with escutcheon pins or screws.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Lighting and power distribution facilities, including panelboards.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 05 00: Common Work Results for Electrical.
3. Section 26 05 13: Basic Electrical Materials and Methods.
4. Section 26 26 00: Power Distribution Units.
5. Section 26 50 00: Lighting.
6. Division 27: Communications.
7. Division 28: Electronic Safety and Security.

1.02 SUBMITTALS

A. Provide in accordance with Division 01.

B. Shop Drawings: Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included.

C. Installation Instructions: Submit manufacturer's written installation instructions.

1.03 DESIGN REQUIREMENTS

A. Panelboards:

1. Panelboards shall be wall-mounted, enclosed safety type with 120/240 volt, three-wire solid neutral 277/480 volt, four-wire or 120/208 volt, four-wire solid neutral mains as indicated on Drawings or specified. First panelboard of each building shall be provided with main or sub-feeder circuit breakers where so indicated.

2. Single pole branches shall be molded case, thermal magnetic circuit breakers with inverse time delay, trip free, quick-make, quick-break mechanism and silver alloy contacts. Circuit breakers shall be fully rated, with ampere rating marked on handle and shall indicate on/off and tripped positions. Ground fault interrupters shall be incorporated

into circuit breakers where indicated. They shall be listed by UL, or other NRTL as ground fault devices. Provide appropriate lug kit of sufficient size to accommodate the feeders.

3. Two- and three-pole branches shall be enclosed and shall be thermal magnetic circuit breakers with inverse time delay, tamper-proof, ambient compensated, single handle, internal common trip, and quick-make, quick-break mechanism with silver alloy contacts. Circuit breakers shall be fully rated or as otherwise indicated on the Drawings.

4. Main and subfeeder circuit breakers shall be enclosed, thermal magnetic type with inverse time delay, single handle common trip, quick-make, quick-break mechanism, corrosion-resistant bearings and silver alloy contacts. Ampere frame size and trip rating shall be as indicated on Drawings. Breakers over 225 amperes shall be furnished with interchangeable trip units. Handles of main and subfeeder circuit breakers shall be provided cabinet door. Voltage rating shall be as indicated on Drawings.

5. Circuit breakers shall be fully rated and of one-piece, bolt-on type and shall meet short-circuit interrupting capacity requirements indicated on Drawings. Series rated circuit breaker combinations are not acceptable.

6. Internal connections shall be fabricated with plated copper bus bars and the busses shall extend for full length of space available for branch circuit breakers. Feeder cable connectors shall be installed at point of feeder entrance. Terminals shall be furnished with copper conductors. Panelboards fed by conductors having over-current protection greater than 200 amperes shall be protected on supply side by over-current devices having a rating not greater than that of panelboards. Copper bussing shall be fully rated. Heat rated bussing is not acceptable.

7. Except where otherwise indicated, circuit breakers shall be in two vertical rows connected to bus bars in a distributed phase arrangement. Two-pole branches shall be balanced on busses. Single pole branches shall be numbered adjacent to its circuit breaker, with odd numbers on left and even numbers on right.

8. Specified circuit breaker spaces shall be furnished with hardware required for future installation of circuit breakers.

9. Provide locking devices for individual circuit breakers. Padlocking devices shall be secured to circuit breakers and by panel dead front plates.

B. Surge Suppressors: Where indicated on Drawings, provide transient voltage surge suppressors as an integral part of panelboards. Panelboards shall be complete with 200 percent rated copper neutral bus, ground bus and isolated ground bus in addition to requirements of this section. Surge suppressors shall be as follows:

1. Surge Capacity:

   a. Line-to-neutral for wye systems: 80 KA.

   b. Line-to-ground: 80 KA.

c. Neutral-to-ground: 80 KA, three-phase wye.

d. Line-to-neutral plus line-to-ground: 160 KA.

2. UL 1449 2nd Edition Suppressed Voltage Rating for 208/120 Wye System:

a. Line-to-neutral: 400 volts.

b. Line-to-ground: 400 volts.

c. Neutral-to-ground: 400 volts.

d. Maximum continuous over-voltage: 150 volts.

3. EMI/RFI High-Frequency Noise Power Filter (Characteristics):

a. 100 KHz at 444 dB.

b. 100 MHz at 44 dB.

c. 10 MHz at 44 dB.

d. 100 MHz at 444 dB.

4. Metal Oxide Varistor (MOV) shall be thermally protected for low current faults and shall be fused with surge-rated fuses. The surge-rated surge current passes and clears the circuit safely if the surge capacity is exceeded. Enhanced diagnostics shall continuously monitor the unit's status and shall include LEDs to signal a reduction in surge capacity or the loss of a suppression circuit. An audible alarm, with test and silence features, shall be furnished in diagnostic package.

5. Each phase or the entire unit shall be replaceable and have bolted-on, tin-plated copper connections. Unit to have UL witnessed fault current rating of 65,000 symmetrical amperes.

6. Surge suppression units shall comply with the following:

a. UL certified.

b. UL 1283.

c. UL 1449.

d. IEEE C 62.45.

e. IEEE C 62.41.

f. Nationally Recognized Testing Laboratory (NRTL) or equal.

C. Panelboard Cabinets:

1. Panelboard cabinets shall be code gage galvanized steel or blue steel; fronts, doors, and trims shall be code gage furniture steel. Cabinets shall be furnished with at least six-inch high gutters at top and bottom where feeder cable size exceeds four gage or where feeder cable passes through cabinet vertically. Cabinets shall be furnished with top and bottom gutters sized as required by inspection department having jurisdiction, but never less than six inches where more than one feeder enters top or bottom of cabinets. Side gutters shall not be less than four inches wide. Width of cabinets shall be 20 inches, unless otherwise indicated on Drawings.

2. Doors shall be cut true, shall accurately fit opening and finish smooth across joints. Rabbets shall be inside. Hinges shall be entirely concealed except for barrels and pins. Hinge flanges shall be welded to door and trim. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors, keyed to Corbin No. 60 keys.

3. Where contactors, time switches, and control devices are specified or indicated to be installed within panelboard cabinets, a separate compartment and door shall be provided at top of cabinet for such devices. Door shall be sized as required to permit removal of contactor and other devices intact. Gutters shall be provided at sides and top of compartment. Doors shall be equipped with flush type, spring-latching, Corbin locks for metal doors keyed to Corbin No. 60 keys.

4. Provide and install panelboard manufacturer's permanent circuit number kit option.

5. Panelboards with control devices in compartment shall arrive at the Project site completely assembled with control devices installed and wired.

6. Outdoor cabinets shall be NEMA Type 3R. Construction shall be formed from code gage galvanized steel with ANSI No. 61 gray enamel finish. Provide heavy-duty, three point latching, vault type door handles with padlocking provisions. Provide stainless steel or galvanized butt hinges on doors. Padlocks shall be furnished, keyed to Corbin No. 60 keys.

7. Self-tapping screws and bolts not permitted.

D. Panelboard Schedule: Provide a neatly typewritten schedule with number or name of room or area, or load served by each panelboard circuit. Room numbers or names shall be determined at the Project site and shall not necessarily be those indicated on the Drawings. Schedule shall also indicate panel designation, voltage and phase, building and distribution panel or switchboard from which it is fed. Schedule shall be installed in a frame under transparent plastic 1/32 inch thick on inside of each panelboard cabinet door.

E. Panelboard nameplate: Provide a nameplate identifying panelboard. Plates shall be black and white plastic nameplate stock, with character cut through black exposing white and shall bare designation of service. Name plate shall be mechanically fastened to switchboard.

F. Provide additional labeling on dead-front of panelboard. Label shall be a P-Touch or equal with a minimum width of 3/8 inch with black letters on white background. Label shall re-identify panelboard and also identify name and location of power source feeding this panel. Location information shall include building name if located in different building and name or room location. If power source is installed in same room, label should indicate source name and "In this Room"

G. Panelboard Standards: Panelboards shall be UL, or other NRTL listed and labeled. Panelboards shall meet latest revisions of following standards:

1. California Electric Code, Article 384.

2. UL 67, Panelboards.

3. UL 50, Cabinets and Boxes.

4. UL 943, GFCI.

5. UL 489, Molded Case Circuit Breakers.

6. NEMA PB1.

7. Federal Specifications W-P- 115C and WC-375B.

H. Signal Terminal Cabinets:

1. Signal terminal cabinets shall conform to the Specifications for panelboard cabinets, except as modified herein.

2. Terminal cabinets shall be flush type, with two-inch trim or surface mounted type, as indicated on Drawings. Terminal cabinets shall be furnished with sections and barriers to separate each system. Sections over 24 inches in width shall be provided with double doors and locks. Terminal cabinets, or sections of terminals housing separate systems, shall measure 12 inches long by 18 inches high by 5 ¾-inch deep, unless otherwise indicated on Drawings. Trims for sectional cabinets shall be of one-piece construction.

3. Terminal cabinets shall be furnished with ¾ inch thick plywood. Plywood shall be fastened in place with machine screws or factory installed mounting screws.

4. Flush-mounted terminal cabinets shall be finished as specified for flush-mounted panelboard cabinets. Surface and semi-flush mounted terminal cabinets shall be finished as specified for surface-mounted panelboard cabinets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Panelboards shall be manufactured by Siemens, W.A. Benjamin, General Electric, Cutler Hammer, Square D or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboards shall be located so they are readily accessible and not exposed to physical damage.

B. Panelboards installed outdoors shall be specifically listed for wet locations and shall be weatherproof in NEMA Type 3R cabinets.

C. Panelboard locations shall provide sufficient working space around panels to comply with the California Electrical Code.

D. Panelboards shall be securely fastened to structure and mounted on surface by at least four points.

E. Unused openings in cabinets shall be effectively closed as required by the manufacturer.

F. Cabinets shall be grounded as specified in Article 250 of the California Electrical Code.

G. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the enclosure.

H. Lugs shall be suitable and listed for installation with the conductor being connected.

I. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

J. Maintain the required bending radius of conductors inside the cabinet.

K. Clean the cabinet of foreign material such as cement, plaster, and paint.

L. Distribute and arrange conductors neatly in the wiring gutters.

M. Use the manufacturer's torque values to tighten lugs.

N. Before energizing panelboards, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been provided.

2. Remove shipping blocks from component devices and panelboard interiors.

3. Manually exercise circuit breakers to verify they operate freely.

4. Remove debris from panelboard interior.

O. Follow manufacturer's instructions for installation.

P. Do not install in highly corrosive environments, unless rated for the application.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 24 19 - MOTOR CONTROL CENTER AND MOTOR CONTROL DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Disconnect switches and motor starters for motors or equipment and connections to the motors.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Division 23: Heating, Ventilating, and Air Conditioning “HVAC”.

3. Section 26 05 00: Common Work Results for Electrical.

4. Section 26 05 13: Basic Electric Materials and Methods.

5. Section 26 05 26: Grounding and Bonding.

6. Section 26 24 13: Switchboards.

1.02 SUBMITTALS

A. Shop Drawings: Include a front elevation, indicating dimensions, make, location and capacity of equipment, type of wiring, size of gutters, type of mounting, size of anchoring bolts and finish. Installation shall be in compliance with CBC seismic design requirements.

B. Product Data: Submit catalogs indicating make, ratings, dimensions, and catalog number for disconnect switches, motor starters, and control devices.

1.03 DESIGN REQUIREMENTS

A. Motor overload protection of manual reset type, as part of a motor starter and set at not to exceed 125 percent of motor full load current rating, shall be provided for each motor exceeding 1/8 horsepower in size except where indicated otherwise and except for following: Motors of sufficient impedance to prevent overheating on failure to start (such as clock motors), and motors provided with an approved built-in manual reset type device, responsive to motor current and set at not to exceed 125 percent of the motor full load current rating, which will interrupt current to motor.

B. Switchboard components shall be provided with nameplates. Plates shall be black and white plastic stock, with characters cut thorough black exposing white, and shall bear designation of service, feeders controlled, and fuse sizes.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Motor Control Centers:

1. Motor control centers shall be of metal-clad, free floor-standing dead-front type, totally enclosed with one or more vertical sections. Arrangement and construction shall be as indicated on Drawings and as specified. Design, construction, and testing shall comply with requirements of latest CEC, UL publication UL-845, NEMA publication ICS 2.3 and applicable standards of ASA, AIEE, and NEMA. Equipment shall be completely fabricated, wired and tested at factory, and shall be shipped in sections ready for installation, complete with required assembly bolts and mounting channels. General construction shall consist of modular vertical sectioned cubicles, approximately 90 inches high and 20 inches wide. Sectional cubicles shall be bolted together to form required arrangement having the appearance of a single assembly. Cubicle sections shall be fabricated from a minimum of 12 gage P & O Mill prime sheet steel, shaped, reinforced, and welded to form a rigid structure. Sections shall contain required number of modular spaces for various starter units. Wiring gutters shall extend through cubicles with front accessible bolted filler plate covers. Connections shall be securely bolted together with corrosion-resistant plated carbon steel, of minimum grade five machine screws, secured with constant pressure type locking devices. Self-tapping screws will not be permitted.

2. Bus bars and connections shall be copper. Vertical buses shall be rated at not less than 300 amperes and shall be placed to allow starter units to be connected by pushing into place. Bus connections shall be free fitting and bolted, with silver plated connecting areas rated at 200 amperes per square inch. Bus work bracing and support shall withstand the short circuit stresses indicated on Drawings without damage to buses or structure. Connections shall be secured bolted together with corrosion-resistant plated carbon steel, of minimum grade five machine screws, secured with constant pressure type locking devices. Self-tapping screws will not be permitted

3. Main horizontal and vertical buses shall be made of copper and entire length shall be electrolytically silver-plated. Copper ground lugs shall be provided in incoming line vertical sections. Horizontal tin-plated copper ground buses shall be provided in each section of the motor control center. Horizontal ground bus shall run continuously throughout control center, drilled and tapped every ten inches for ¼ - 20 machine screws. RMS amperes symmetrical bus bracing shall be as indicated on Drawings. Vertical sections shall support horizontal and vertical buses, combination started units, covers and doors. Vertical sections shall be furnished with structural supporting members formed of a minimum of 13 gage hot-rolled steel. Reinforcement for structural parts shall be of ten gage steel to provide a strong, rigid assembly. Vertical sections shall be designed to accommodate bolts on units 20 inches wide and 20 inches deep, and shall be provided with 12 inches high horizontal wireway located at bottom of sections and a six-inch horizontal wireway at top of sections in addition to the vertical wireways for each section. Busing components shall be secured bolted together with corrosion-resistant plated carbon steel, of minimum grade five machine screws, secured with constant pressure type locking devices. Self-tapping screws will not be permitted

4. Separate control cell compartments of sizes indicated on Drawings shall be provided for future interlocking relays and transducers.

5. Starters shall be of the bolt-on combination magnetic type, as indicated on Drawings, each with a separate hinged door. Starters shall be provided with separate overloads in each phase.

   a. Combination magnetic starters shall be circuit breaker magnetic across-the-line type, or as indicated on Drawings, and shall be furnished with suitable thermal overload elements for controlled motor. Breaker shall be bussed with copper bus bars. Covers shall be mechanically interlocked with circuit breakers to prevent opening when energized. Circuit breaker handles shall be capable of being padlocked in the off position with one to three padlocks.

   b. Each motor starter shall be furnished with a red pilot light, HOA selector switch or pushbutton station, and a control circuit transformer, unless otherwise indicated on Drawings. Control circuit transformer shall be fused.

6. Units shall be provided with unit doors, unit support pans, unit saddles, and unit disconnect operators. Units shall be designed and constructed so that faults will be localized within compartment.

7. Control devices and wiring of motor control centers shall be in accordance with functional wiring diagrams indicated on Drawings and requirements of controlled equipment.

8. Motor control center wiring shall be NEMA Class 1, Type B.

9. Motor control center shall be as manufactured by Cutler Hammer, W.A. Benjamin Electric, Square D, General Electric, or equal.

B. Disconnect Switches:

1. Heavy duty type switches shall be 240 volt or 480 volt as required, totally enclosed, externally operated, with quick-make, quick-break operating mechanism, interlock cover, and provisions for locking cover in closed position and locking switch in on and off positions. Switches shall be single-throw, unless otherwise indicated or specified. Switches controlling direct current loads shall be DC rated.

2. Switches shall be furnished with switch blades, which are fully visible in off position when switch door is open. Current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall be furnished with removable arch suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL, or other Nationally Recognized Testing Lab listed for 75 degrees C. copper wires.

3. Switch enclosure shall be NEMA Type 1 for indoor locations and rain-tight, NEMA Type 3R, rainproof for outdoor locations. NEMA Type 3R enclosures shall be manufactured from galvanized steel with gray baked enamel and shall be furnished complete with rainproof bolt on hubs. Covers shall be attached with pin type hinges. Removable closing cap types are not permitted. In kitchen area, provide disconnect switches in a NEMA type 4 stainless steel enclosure. Quick release latches shall be permitted only when furnished tamper-resistant to prevent breakage due to vandalism, and furnished with Corbin 66 locks keyed to Corbin 60 key. Switches shall be fusible or non-fusible as indicated on Drawings. Fusible switches shall accept cartridge fuses. Current rating of switches, number of poles, solid neutral facilities, and current rating

of fuses shall be as indicated on Drawings. Switches shall have proper horsepower rating equal to or greater than horsepower of motor controlled. Only lower horsepower rating of dual rated switches will be permitted as a switch rating. Switches shall accept Class H, Class J and Class R fuses.

4. Padlocking device shall lock operating handle and cover with one padlock regardless of on or off position. Switches shall be heavy duty type, as manufactured by Square D, General Electric, Cutler Hammer or equal. Furnish a minimum of two padlocks and two keys with each switch. Padlocks shall be Corbin No. 66 keyed to Corbin No. 60 keys.

5. Switches shall be UL listed and shall comply with NEMA Standard KS-1.

6. Furnish one spare fuse for each fusible disconnect switch installed. Spare fuses shall be same type and rating as those installed.

C. Motor Starters:

1. Motor starters shall be AC magnetic across-line starters unless otherwise indicated on Drawings.

2. AC magnetic across-the-line starters shall be furnished with manual reset thermal overload protective devices including heating elements. Starters shall be furnished in a NEMA Type 1, NEMA Type 3R or other type of enclosure as indicated on Drawings. Starters shall be furnished with HOA selector switches or push-buttons, as indicated on Drawings. NEMA size, voltage rating, number of poles, and special features shall be as indicated on Drawings. Horsepower rating of each starter shall be equal to or greater than motor horsepower. Starters for motor circuits rated at 208 volts and above shall be provided with a control circuit transformer, having a 120 volt secondary. Combination magnetic starters are permitted. Three-phase starters shall be furnished with three-element protection.

3. Manual across-line starters shall be furnished with manual reset thermal overload protective devices, including heating elements, start-stop-reset device or H.O.A. switch as indicated on Drawings, operable from front. Enclosure shall be NEMA Type 1 for indoor installation and NEMA Type 3R for outdoor installation or as indicated on the Drawings. NEMA size, voltage rating and number of poles shall be determined by motor horsepower, voltage and phase indicated on Drawings. Horsepower rating of each starter shall be equal to or greater than motor horsepower. Combination manual starters are permitted.

4. Thermal switch starters shall be tumbler type with plaster ears, binding screws for wiring, standard size composition cups which fully enclose mechanism, and shall be designed to fit standard outlet boxes. Thermal switches shall be fractional horsepower motor starters with thermal overload protective devices including heating elements and with handle providing on-off-reset control. Horsepower rating, voltage rating, and number of poles shall be determined from motor horsepower and voltage indicated on Drawings. Switches shall be key operated where so indicated on Drawings. Furnish one key with each key type switch. Horsepower rating of each switch shall be equal to or greater than motor horsepower.

5. Relays furnished for directly controlling motors shall be installed in NEMA Type 1 enclosure for indoor installations and NEMA Type 3R for outdoor installations, unless

otherwise indicated or specified and shall be horsepower rated. Relay size, voltage rating and number of poles shall be determined from motor horsepower and voltage indicated on Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Motor control centers installed outdoors, or below grade, shall be installed on a concrete pad as specified in Section 03 3000: Cast-In-Place Concrete, and as indicated on Drawings.

B. Anchor bolts for freestanding equipment shall be designed to meet CBC seismic requirements. Equipment shall be anchored to concrete slab with anchor bolts. Provide structural drawings for Architect review prior to start of construction.

C. Equipment shall be located so that it is readily accessible and not exposed to physical damage.

D. Equipment locations shall provide sufficient working space around the equipment to comply with the California Electrical Code.

E. Equipment installed outdoors shall be specifically approved for wet locations and shall be installed in a weatherproof NEMA Type 3R enclosure.

F. Equipment shall be securely fastened to the mounting surface.

G. Equipment enclosure shall be grounded to comply with Article 250 of the California Electrical Code.

H. Conduits shall be installed so as to prevent moisture or water from entering and accumulating within the equipment enclosure.

I. Lugs shall be suitable and permitted for installation with the conductor being connected.

J. Conductor lengths shall be maintained to a minimum within the wiring space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

K. Maintain the required bending radius of conductors inside the cabinet.

L. Distribute and arrange conductors neatly within the equipment space.

M. Tightening of wire lugs or any conductor connections shall be performed in the presence of the Project Inspector. Torque values shall be those recommended by manufacturer.

N. Remove shipment blocks from component devices.

O. Manually exercise switches and circuit breakers to verify they operate freely.

P. Remove debris from equipment interior.

Q. Follow manufacturer's instructions for installation.

R. Furnish one spare fuse for each fusible switch installed. Spare fuses shall be of the same type and rating as those installed.

S. Record Drawings: Submit project record drawings indicating the motor control center exactly as it was installed, including wiring diagrams of components.

T. Installation Instructions: Submit manufacturer's written installation instructions, including recommendations for handling, protection and storage.

U. Installation in corrosive environments such as boiler rooms, pool equipment, and other similar spaces is not allowed.

V. Motor Control Center equipment and system components shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of bolted electrical connections, perform insulation resistance tests on each bus section, phase-to-phase and phase-to-ground for one minute in accordance with requirements stated in NETA-ATS 2007 table 100.1. Test shall be performed in the following manner:

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of bussing, circuit breakers and/or fused switches. The fused switches shall be equipped with fuses or temporary jumpers in place of fuses. Breaker and fused switches shall be tested in the closed position. No wiring shall be connected to the line or load side of the motor control center during testing.

    a. Provide calibration program records to assure the testing instruments to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

    b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

    c. Test reports shall include the following:

        1) Identification of the testing organization.

        2) Equipment identification.

        3) Ambient conditions.

        4) Identification of the testing technician.

        5) Summary of project.

        6) Description of equipment being tested.

        7) Description of tests.

8) Test results.

9) Analysis, interpretation and recommendations.

2. Perform test in the presence of the Project Inspector.

3. During testing, provisions shall be made to prevent damage to any solid state components, or electronic equipment such as TVSS equipment that may be tied onto panel bussing.

4. Test results shall meet manufacturer's recommendations or NETA ATS- 2007 recommendations, whichever is more stringent.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Lighting fixtures, including lamps, wiring, and lighting controls.

B. Light fixtures model numbers were determined at the time this specification was written; model numbers may need to be modified, or may require the addition or deletion of options to fully meet specification requirements.

C. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 05 00: Common Work Results for Electrical.
3. Section 26 05 13: Basic Electrical Materials and Methods.
4. Section 26 05 26: Grounding and Bonding.
5. Section 26 05 19: Low-Voltage Wires (600 Volt AC or less).
6. Section 26 09 23: Lighting Controls Systems.
7. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

A. List of Materials: Submit a complete list of materials proposed for this section.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size of lamps, and complete details of method of fitting suspension and fastening fixtures in place. Provide wiring diagrams for lighting control equipment. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Prior to start of construction; provide photometric calculations with graphic of luminance levels of work plane, ceiling and walls of each rooms. Calculations shall comply with IESNA recommendations.

D. Installation Instructions: Submit manufacturer's written installation instructions for fixtures and accessories.

E. Light fixtures shall be Underwriters Laboratory (UL) or Nationally Recognized Testing Laboratory (NRTL) listed, and in compliance with applicable industry standards and codes.

F. Submittals must comply with contract general provisions.

1.03 MOUNTING REQUIREMENTS

A. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements for earthquake-resistant construction of the State of California.

B. Provide suspension points at no more than two feet from fixture ends. Spacing between supports shall not exceed eight feet.

1.04 QUALITY ASSURANCE

A. Components and fixtures shall be listed and approved for the intended application by Underwriter's Laboratories (UL), or other Nationally Recognized Testing Laboratory (NRTL).

B. OWNER’s written approval shall be obtained for any equipment or materials substitutions prior to their use.

1.05 GUARANTEE

A. Provide a two year labor warranty.

B. Provide material warranty as specified:

1. Lamps: two years.

2. Standards: one year.

3. Controls: three years.

C. Warranty period begins at substantial completion or project acceptance for beneficial occupancy.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Lighting fixtures shall be the type indicated on Drawings and as specified. Fixtures of same type shall be of one manufacturer.

B. Fixtures shall be of the types and manufacturers described in the LIGHTING FIXTURE SCHEDULE provided in the Electrical drawings, with lamps, wattage and voltage as indicated. Specific manufacturer and model number references are indicated as a standard of performance and quality; other manufacturers’ models may be supplied provided the product meets or exceeds the specifications. The alternate fixtures shall achieve the same photometric levels and uniformity ratios.

C. Fixtures shall be baked-on enamel or powder-coated, unless otherwise specified in subsections below.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install a lighting fixture for each lighting outlet indicated and mark with day of installation.

B. Fixture voltage shall be as indicated on Drawings.

C. Install recessed and surface-mounted fixtures, with plaster frames compatible with ceiling and wall systems employed; secure fixtures mechanically to frames.

D. Align rows of suspended and surface-mounted LED fixtures to form straight lines at uniform elevations.

E. Recessed fixtures shall fit snugly against ceilings to prevent light leakage.

F. Notwithstanding the following paragraphs in Part 3-Execution, fixture installations shall comply with the most current CBSC and Department of State Architect Seismic requirements.

G. Support suspended recessed fixtures in accordance with DSA IR 25-2.10. Support pendant-mounted fixtures in accordance with DSA IR 16-9. Fixture installations shall be coordinated with acoustical and gypsum ceiling installation.

H. Emergency light fixtures shall be labeled “Emergency Fixture” with one inch high letters produced with a P-touch or similar labeling system and shall be put on the housing.

I. Continuous suspended fixtures:

1. Fixture suspension device shall allow vertical adjustment of fixture without the use of tools. Cable shall be minimum seven strand twisted stainless steel capable of supporting minimum four times the fixture weight. For continuous linear suspended fixtures longer than eight feet, provide not less than three suspension points.

2. Top of fixture shall be suspended as shown on the Drawings.

3. Fixture shall utilize factory furnished or approved hardware and canopy for either hard or T-bar ceilings.

J. Where fixtures with emergency battery packs are installed, these fixtures shall receive constant powered circuits. When powering unit inverter power packs, use the same circuit that powers the switched ballast to power the inverter.

K. Surface mount fixtures shall be attached to structure. Toggle bolts shall NOT be used or permitted. Provide backing supported by structure where required.

3.02 TESTING

A. Check and adjust fixtures for required illumination.

B. Test and adjust lighting control equipment for proper operation.

3.03 SPARE PARTS

Provide the following spare parts:

a. Furnish 5% spare lamps with a minimum of one spare lamp of each type.

b. Furnish 5% spare motion detectors of each type with a minimum of one spare detector of each type.

3.04 HAZARDOUS WASTE DISPOSAL

A. Hazardous waste disposals and recycling shall be handled and disposed of by an approved, licensed CONTRACTOR.

B. Store, remove, transport and dispose of hazardous materials in all accordance with state and federal regulations.

C. Provide OWNER with copy of manifest and certificate of destruction and/or recycling no later than achievement of substantial completion.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials from all areas of work each day.

B. Clean fixture surfaces of dirt, cement, plaster and debris. Furnish cleansers compatible with material surfaces being cleaned.

END OF SECTION

HUBBELL Outdoor Lighting

26 50 01A - EXTERIOR LIGHTING CUT SHEETS

DATE: LOCATION:

TYPE: ELT-2 PROJECT: Compton College -VAPA

CATALOG #:

ELT-2 / ELT-2A / ELT-2B / ELT-2C /ELT-2D /ELT-2F

RATIO Wall

RWL1/RWL2 LED WALLPACK

FEATURES

- Low profile LED wall luminaire with a variety of IES distributions for lighting applications such as retail, commercial and industrial building mount
- Featuring Micro Strike Optics which maximizes target zone illumination with minimal losses at the house-side, reducing light trespass issues
- Visual comfort standard
- Control options including photo control, occupancy sensing, NX Distributed Intelligence™, Wiscape and 7-Pin with networked controls
- Battery Backup options available for emergency code compliance
- Quick-mount adapter allows easy installation/maintenance
- 347V and 480V versions for industrial applications and Canada
- Stock versions available in 3500lm and 5500lm configurations at 4000K

C US

BUY AMERICAN SOLUTIONS
See Certification Specifications

RELATED PRODUCTS

Ratio Family Ratio Area Ratio Flood

CONTROL TECHNOLOGY

SiteSync LIGHTING CONTROL NX DISTRIBUTED INTELLIGENCE™ wiSCAPE™

SPECIFICATIONS

CONSTRUCTION

- Die-cast housing with hidden vertical heat fins that are optimal for heat dissipation while keeping a clean smooth outer surface
- Corrosion resistant, die-cast aluminum housing with powder coat paint finish
- Powder paint finish provides durability in outdoor environments. Tested to meet 1000 hour salt spray rating.

OPTICS

- Entire optical aperture illuminates to create a larger luminous surface area resulting in a low glare appearance without sacrificing optical performance
- 48 or 160 midpower LEDs
- 3000K, 4000K or 5000K (70 CRI/80 CRI) CCT
- Zero uplight distributions
- LED optics provide IES type II, III and IV distributions. Type II only available in RWL2 configurations.

INSTALLATION

- Quick-mount adapter provides easy installation to wall or to recessed junction boxes (4" square junction box)
- Designed for direct j-box mount.
- Integral back box contains 1/2" conduit hubs
- Integral back box standard with Dual Driver, Dual Power Feed, NX, Wiscape and battery versions (battery versions for RWL1 only)

ELECTRICAL

- 120V-277V universal voltage 50/60Hz 0-10V dimming drivers
- 347V and 480V dimmable driver option for all wattages above 35W.

ELECTRICAL (CONTINUED)

- Ambient operating temperature -40˚C to 40˚C
- Drivers have greater than .90 power factor and less than 20% Total Harmonic Distortion
- Driver RoHS and IP66
- Field replaceable surge protection device provides 20kA protection meeting ANSI/IEEE C62.41.2 Category C High and Surge Location Category C3; Automatically takes fixture off-line for protection when device is compromised
- Dimming drivers are standard and dimming leads are extended out of the luminaire unless control options require connection to the dimming leads. Must specify if wiring leads are to be greater than 6" standard.

CONTROLS

- Photo control, occupancy sensor and wireless available for complete on/off and dimming control
- Button photocontrol is suitable for 120-277V operation
- 7-pin ANSI C136.41-2013 photocontrol receptacle option available for twist lock photocontrols or wireless control modules (control accessories sold separately)
- NX Distributed Intelligence™ available with in fixture wireless control module, features dimming and occupancy sensor wiSCAPE® available with in fixture wireless control module, features dimming and occupancy sensor
- Integral Battery Backup provides emergency lighting for the required 90 minute path of egress
- Battery Backup suitable for operating temperatures -25˚C to 40˚C

CONTROLS (CONTINUED)

- Dual Driver and Dual Power Feed options creates product configuration with 2 internal drivers for code compliance
- Please consult brand or sales representative when combining control and electrical options as some combinations may not operate as anticipated depending on your application.

CERTIFICATIONS

- Listed to UL1598 and CSAC22.2#250.0-24 for wet locations
- IP65 rated housing
- This product qualifies as a "designated country construction material" per FAR 52.225-11 Buy American-Construction Materials under Trade Agreements effective 04/23/2020. See Buy American Solutions
- DLC® (DesignLights Consortium Qualified), with some Premium Qualified configurations. Please refer to the DLC website for specific product qualifications at www.designlights.org

WARRANTY

- 5 year limited warranty
- See HLI Standard Warranty for additional information

KEY DATA	
Lumen Range	1,000–19,500
Wattage Range	10–155
Efficacy Range (LPW)	118–148
Fixture Projected Life (Hours)	L70>60K
Weights lbs. (kg)	6.5/16.5 (2.9/7.5)

HUBBELL Lighting

HUBBELL Outdoor Lighting

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

ORDERING GUIDE

Example: RWL1–48L-10–3K7–2–UNV–BLS–E

CATALOG # _____

ORDERING INFORMATION

Series		# LEDs - Wattage		CCT/CRI		Distribution		Voltage		Color	
RWL1	Ratio Wall 1	**48L-10**	1,000 Lumens[4]	**3K7**	3000K, 70 CRI	**2**	IES TYPE II[1]	**UNV**	120-277V	**BLT**	Black Matte Textured
		48L-15	2,000 Lumens[4]	**4K7**	4000K, 70 CRI	**3**	IES TYPE III	**120**	120V	**BLS**	Black Gloss Smooth
		48L-20	2,500 Lumens[4]	**5K7**	5000K, 70 CRI	**4W**	IES TYPE IV	**208**	208V	**DBT**	Dark Bronze Matte Textured
		48L-25	3,500 Lumens[4]					**240**	240V	**DBS**	Dark Bronze Gloss Smooth
		48L-35	4,500 Lumens					**277**	277V	**GTT**	Graphite Matte Textured
		48L-45	5,500 Lumens[4]					**347**	347V	**LGS**	Light Grey Gloss Smooth
RWL2	Ratio Wall 2	**160L-45**	6,500 Lumens					**480**	480V	**LGT**	Light Grey Matte Textured
		160L-50	7,500 Lumens							**PSS**	Platinum Silver Smooth
		160L-65	9,500 Lumens							**WHT**	White Matte Textured
		160L-80	11,000 Lumens							**WHS**	White Gloss Smooth
		160L-95	13,000 Lumens							**VGT**	Verde Green Textured
		160L-115	15,000 Lumens							**Color Option**	
		160L-135	17,500 Lumens							**CC**	Custom Color
		160L-155	19,500 Lumens								

Control Options Network	
NXWE	NX Wireless Enabled (module + radio)[4,7]
NXSPW_F	NX Wireless, PIR Occ. Sensor, Daylight Harvesting[4,5,7]
NXSP_F	NX, PIR Occ. Sensor, Daylight Harvesting[4,5,7]
WIR	Wireless Controls, wiSCAPE™[2,6]
Stand Alone Sensors	
SCP-8F	Remote control programmable line voltage sensor[3,4]
SCP-20F	Remote control programmable line voltage sensor[3,4]
Control Options	
7PR_	7-Pin Receptacle[6]

Options	
F	Fusing (must specify voltage)
E	Emergency Battery Backup[7,8,9]
EH	Emergency Battery w/ Heater Option[7,8,9]
2DR	Dual Driver[4,6]
2PF	Dual Power Feed[4,6]
PC	Button Photocontrol[8]

Notes:
1. Only available with RWL2
2. wiSCAPE Gateway required for system programming
3. Specific voltage selection is required
4. Not available with 480V
5. Replace "_" with "14" for up to 14' mounting height, "40" for up to 40' mounting height
6. This item is located in the integral backbox which will be automatically added onto the fixture if chosen.
7. This item is located in the integral backbox for RWL1 configurations only.
8. Option only available at 120 or 277V
9. Only available with RWL1

STOCK ORDERING INFORMATION

Catalog Number	Lumens	Wattage	LED Count	CCT/CRI	Voltage	Distribution	Finish
RWL1-48L-25-4K-3	3500lm	25	48L	4000K/70CRI	120-277V	Type III	Dark Bronze Textured
RWL1-48L-25-4K-4W	3500lm	25	48L	4000K/70CRI	120-277V	Type IV Wide	Dark Bronze Textured
RWL1-48L-45-4K-3	5500lm	45	48L	4000K/70CRI	120-277V	Type III	Dark Bronze Textured
RWL1-48L-45-4K-4W	5500lm	45	48L	4000K/70CRI	120-277V	Type IV Wide	Dark Bronze Textured

CONTROLS

Control Options	
Standalone	
SCPREMOTE	Order at least one per project location to program and control

ACCESSORIES AND REPLACEMENT PARTS - MADE TO ORDER

	Catalog Number	Description
☐	**WP-BB-XXX**	Accessory for conduit entry[1]

Notes:
1. replace "xxx" with color option

HUBBELL Lighting

HUBBELL Outdoor Lighting

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

HUBBELL Lighting

HUBBELL Outdoor Lighting

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

LUMINAIRE AMBIENT TEMPERATURE FACTOR (LATF)

Ambient Temperature		Lumen Multiplier
0°C	32°F	1.03
10°C	50°F	1.01
20°C	68°F	1.00
25°C	77°F	1.00
30°C	86°F	0.99
40°C	104°F	0.98
50°C	122°F	0.97

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

PROJECTED LUMEN MAINTENANCE

Ambient Temperature	OPERATING HOURS					
	0	25,000	TM-21-11 L90 36,000	50,000	100,000	L70 (Hours)
25°C / 77°F	1.00	0.97	0.96	0.95	0.91	408,000
40°C / 104°F	0.99	0.96	0.95	0.94	0.89	356,000

ELECTRICAL DATA

# OF LEDS	Nominal Wattage	Input Voltage	Oper. Current (Amps)	System Power (Watts)
RWL1	10	120	0.08	10.1
		208	0.05	
		240	0.04	
		277	0.04	
		347	0.03	
		480	0.02	
	15	120	0.12	14.5
		208	0.07	
		240	0.06	
		277	0.05	
		347	0.04	
		480	0.03	
	20	120	0.17	19.9
		208	0.10	
		240	0.08	
		277	0.07	
		347	0.06	
		480	0.04	
	25	120	0.23	28.0
		208	0.13	
		240	0.12	
		277	0.10	
		347	0.08	
		480	0.06	
	35	120	0.31	36.9
		208	0.18	
		240	0.15	
		277	0.13	
		347	0.11	
		480	0.08	
	45	120	0.39	46.5
		208	0.22	
		240	0.19	
		277	0.17	
		347	0.13	
		480	0.10	

# OF LEDS	Nominal Wattage	Input Voltage	Oper. Current (Amps)	System Power (Watts)
RWL2	45	120	0.38	46.1
		208	0.22	
		240	0.19	
		277	0.17	
		347	0.13	
		480	0.10	
	50	120	0.45	54.0
		208	0.26	
		240	0.23	
		277	0.19	
		347	0.16	
		480	0.11	
	65	120	0.56	67.2
		208	0.32	
		240	0.28	
		277	0.24	
		347	0.19	
		480	0.14	
	80	120	0.67	80.8
		208	0.39	
		240	0.34	
		277	0.29	
		347	0.23	
		480	0.17	
	95	120	0.78	93.2
		208	0.45	
		240	0.39	
		277	0.34	
		347	0.27	
		480	0.19	
	115	120	0.92	109.8
		208	0.53	
		240	0.46	
		277	0.40	
		347	0.32	
		480	0.23	
	135	120	1.14	137.1
		208	0.66	
		240	0.57	
		277	0.49	
		347	0.40	
		480	0.29	
	155	120	1.31	156.8
		208	0.75	
		240	0.65	
		277	0.57	
		347	0.45	
		480	0.33	

HUBBELL Lighting

HUBBELL Outdoor Lighting

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

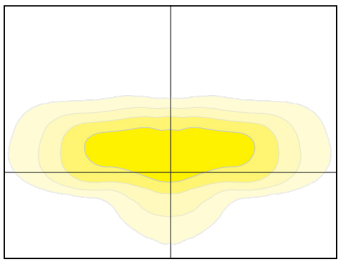
RATIO WALL

RWL1/RWL2 LED WALLPACK

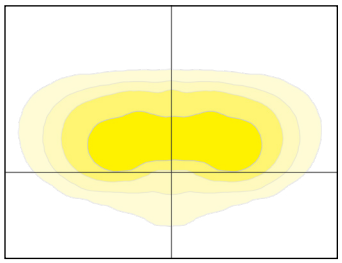
PHOTOMETRY

Mounting Height: 30ft

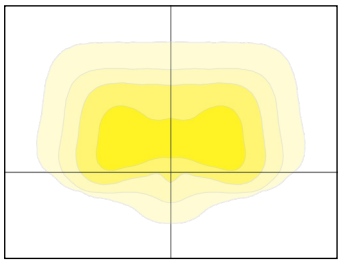
Type II



Type III

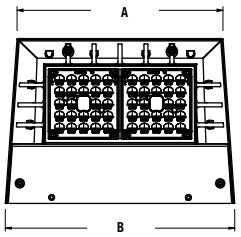


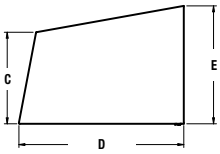
Type VI



DIMENSIONS

RWL1

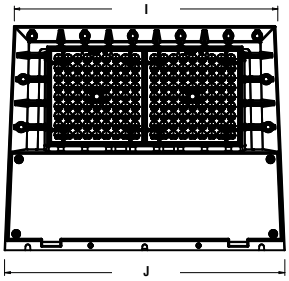


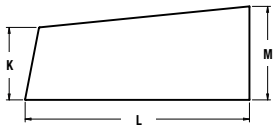


A	B	C	D	E
8.7"	9.7"	3.9"	7.0"	5.0"
221mm	246mm	99mm	178mm	127mm

Weight
6.5 lbs (2.95 kgs)

RWL2

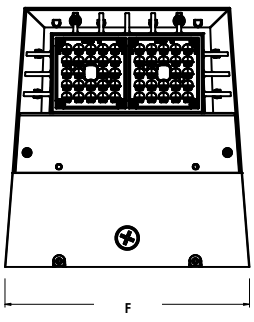


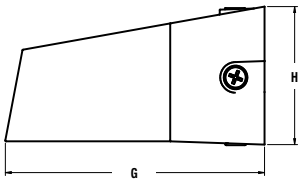


I	J	K	L	M
14.0"	15.0"	3.9"	12.0"	5.0"
356mm	381mm	99mm	305mm	127mm

Weight
16.5 lbs (7.48 kgs)

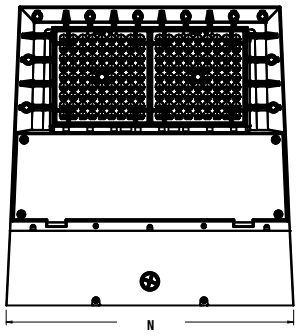
RWL1 with Integral Back Box

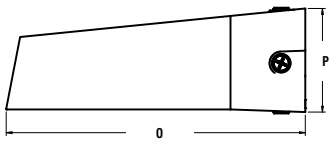




F	G	H
10.4"	11.0"	5.9"
264mm	279mm	150mm

RWL2 with Integral Back Box





N	O	P
15.4"	16.0"	5.5"
391mm	406mm	140mm

HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

HUBBELL Outdoor Lighting

DATE: LOCATION:

TYPE: PROJECT:

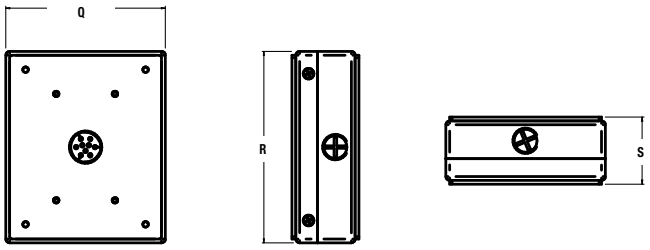
CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

DIMENSIONS (CONTINUED)

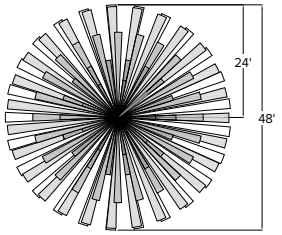
Back Box Accessory

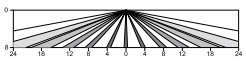


Q	R	S
4.9" 124mm	5.9" 150mm	2.1" 53mm

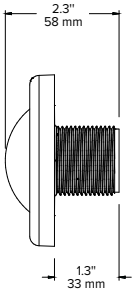
ADDITIONAL INFORMATION

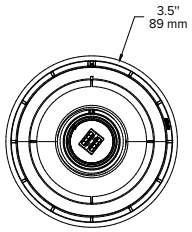
NXSP-14F



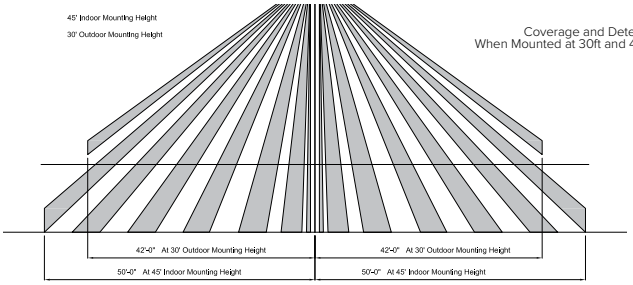


Sensor Lens Coverage and Detection Patterns
When Mounted at 8ft with Low Mount Lens

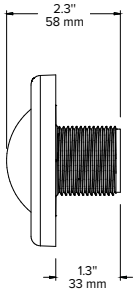


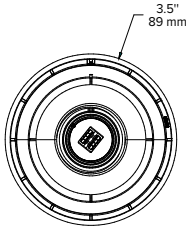


NXSP-40F

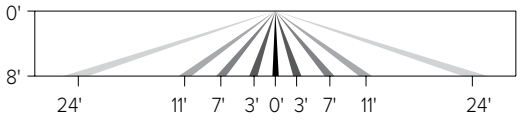


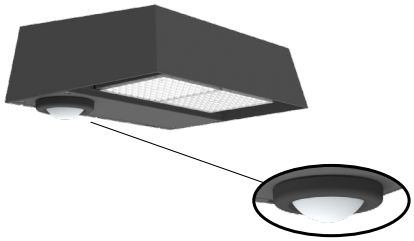
Coverage and Detection Patterns
When Mounted at 30ft and 45ft with Standard Lens

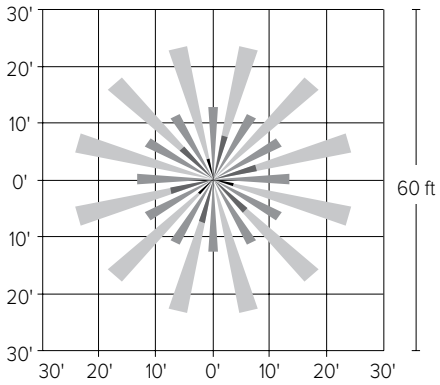


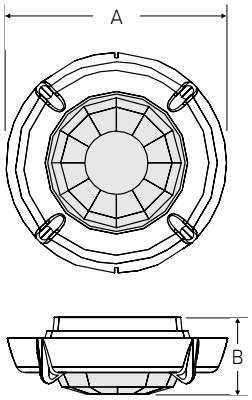


SCP-8F









A	B
2.3" (59mm)	.8" (20mm)

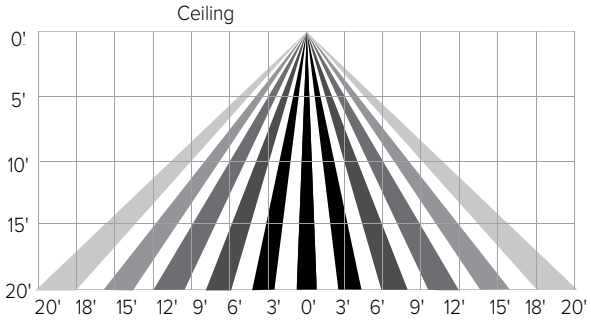
HUBBELL Lighting

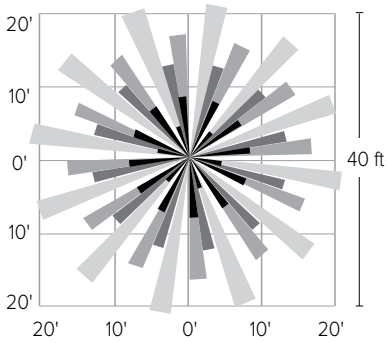
HUBBELL Outdoor Lighting

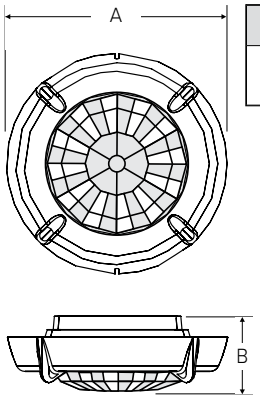
RATIO WALL

RWL1/RWL2 LED WALLPACK

SCP-20F

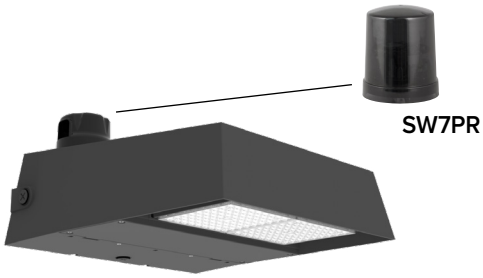






A	B
2.3" (59mm)	.8" (20mm)

SITESYNC 7-PIN MODULE



SW7PR

SiteSync™ LIGHTING CONTROL

- SiteSync features in a new form
- Available as an accessory for new construction or retrofit applications (with existing 7-Pin receptacle)

HUBBELL Lighting

HUBBELL®
Outdoor Lighting

DATE: LOCATION:

TYPE: ELT-02 PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

HUBBELL®
Lighting

HUBBELL®
Outdoor Lighting

DATE: LOCATION:

TYPE: ELT-02A PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

HUBBELL®
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HUBBELL®
Outdoor Lighting

DATE: LOCATION:

TYPE: ELT-02B PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

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Outdoor Lighting

DATE: LOCATION:

TYPE: ELT-02C PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

HUBBELL®
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DATE: LOCATION:

TYPE: ELT-02D PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

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Outdoor Lighting

DATE: LOCATION:

TYPE: ELT-02F PROJECT: Compton College - VAPA

CATALOG #:

RATIO WALL

RWL1/RWL2 LED WALLPACK

PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 70 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
RWL1	10	10.1	3	1362	135	0	0	1	1355	134	0	0	1	1303	129	0	0	1
			4W	1343	133	0	0	1	1336	132	0	0	1	1285	127	0	0	1
	15	14.5	3	1972	136	1	0	1	1962	135	1	0	1	1887	130	1	0	1
			4W	1945	134	0	0	1	1935	133	0	0	1	1861	128	0	0	1
	20	19.9	3	2722	137	1	0	1	2709	136	1	0	1	2605	131	1	0	1
			4W	2685	135	1	0	1	2672	134	1	0	1	2569	129	1	0	1
	25	28.0	3	3749	134	1	0	1	3732	133	1	0	1	3588	128	1	0	1
			4W	3698	132	1	0	1	3680	131	1	0	1	3538	126	1	0	1
	35	36.9	3	4751	129	1	0	2	4728	128	1	0	2	4546	123	1	0	1
			4W	4685	127	1	0	2	4663	126	1	0	2	4483	121	1	0	2
	45	46.5	3	5812	125	1	0	2	5784	124	1	0	2	5562	120	1	0	2
			4W	5731	123	1	0	2	5704	123	1	0	2	5485	118	1	0	2
RWL2	45	46.1	2	6701	145	1	0	2	6668	145	1	0	2	6412	139	1	0	2
			3	6812	148	1	0	2	6780	147	1	0	2	6519	141	1	0	2
			4W	6678	145	1	0	2	6646	144	1	0	2	6390	139	1	0	2
	50	54.0	2	7747	143	1	0	2	7710	143	1	0	2	7413	137	1	0	2
			3	7876	146	1	0	2	7838	145	1	0	2	7537	140	1	0	2
			4W	7720	143	1	0	2	7683	142	1	0	2	7388	137	1	0	2
	65	67.2	2	9539	142	1	0	2	9494	141	1	0	2	9129	136	1	0	2
			3	9699	144	2	0	2	9652	144	2	0	2	9281	138	2	0	2
			4W	9507	141	2	0	2	9461	141	2	0	2	9097	135	2	0	2
	80	80.8	2	11228	139	2	0	2	11174	138	2	0	2	10745	133	2	0	2
			3	11416	141	2	0	2	11361	141	2	0	2	10924	135	2	0	2
			4W	11190	138	2	0	2	11136	138	2	0	2	10708	133	2	0	2
	95	93.2	2	13148	141	2	0	2	13085	140	2	0	2	12582	135	2	0	2
			3	13368	143	2	0	2	13304	143	2	0	2	12792	137	2	0	2
			4W	13103	141	2	0	2	13040	140	2	0	2	12539	135	2	0	2
	115	109.8	2	15102	138	2	0	3	15030	137	2	0	3	14452	132	2	0	3
			3	15354	140	2	0	3	15281	139	2	0	3	14693	134	2	0	3
			4W	15050	137	2	0	3	14978	136	2	0	3	14402	131	2	0	3
	135	137.1	2	17533	128	2	0	3	17449	127	2	0	3	16778	122	2	0	3
			3	17826	130	2	0	3	17740	129	2	0	3	17058	124	2	0	3
			4W	17473	127	2	0	3	17389	127	2	0	3	16720	122	2	0	3
	155	156.8	2	19495	124	2	0	3	19402	124	2	0	3	18656	119	2	0	3
			3	19821	126	2	0	3	19726	126	2	0	3	18967	121	2	0	3
			4W	19542	125	2	0	3	19448	124	2	0	3	18700	119	2	0	3

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ELT-3
ELT-3A

Compton College -VAPA

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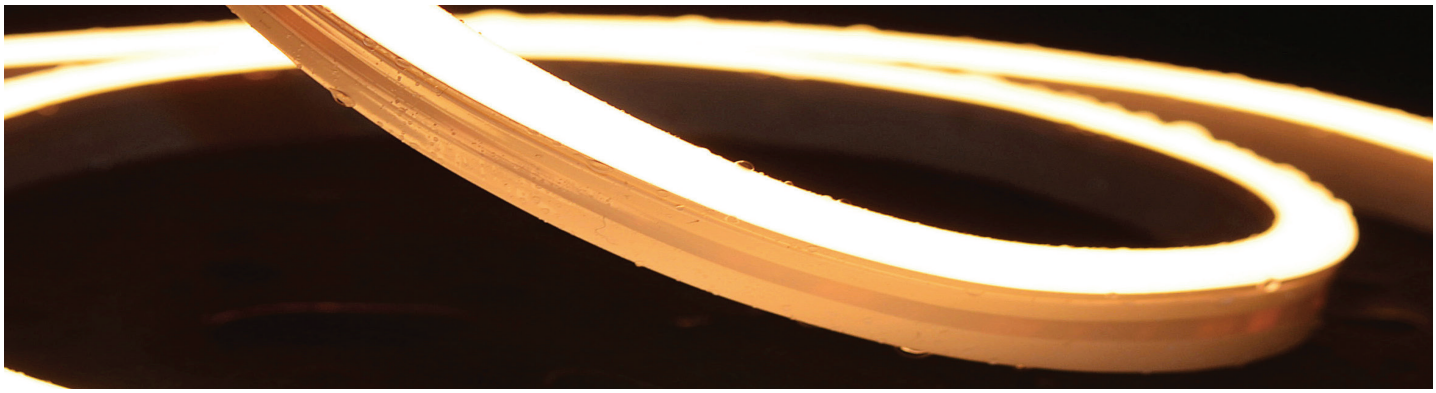
TRACE

HORIZONTAL



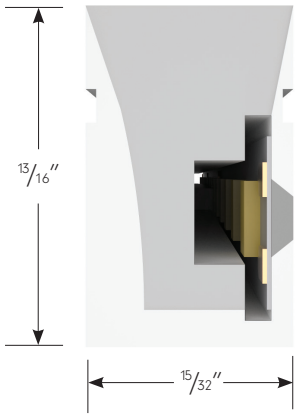
Project: Compton College -VAPA Type: ELT-3 - ELT-3A

Product Features

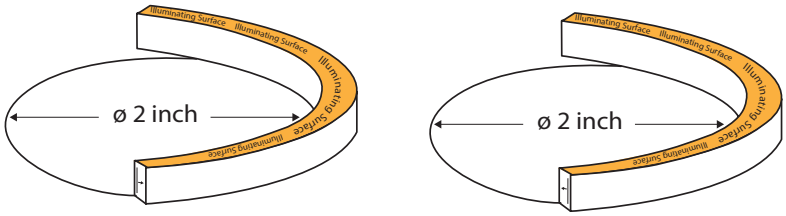
- Constructed using flexible SMD LEDs with zero voltage drop for reliability and uniformity of light
- Used to outline structures or where traditional glass neon is used
- Low Voltage 24V DC
- Available in Non-Dimming or Dimming version
- Long-life LEDs with tight cutting increments for precise field installation
- UV Stabilized for exterior use with silicone housing (no yellowing or cracking)
- IP67 Rating
- IK07 Rating - protected against 2 joules impact
- 1 Bin, 1.5 step color consistency

IK07 IP67 UL LISTED

Dimensions



TRACE Horizontal Bending Direction



Lateral Bending

Order Specification Guide

NOTE: Lengths and quantity of each run must be submitted at time of order.
TRACE is factory prep only. In-field cutting will void warranty.

PRODUCT CODE		INTENSITY		PROFILE		LED COLOR		VOLTAGE
TRCE	-		-	**H**	-		-	**24**
TRCE = Trace Flexible Light		**L** = Low Output **S** = Standard Output **H** = High Output		**H** = Horizontal		**24** = 2400K **27** = 2700K **30** = 3000K **35** = 3500K* **40** = 4000K **50** = 5000K* **GR** = Green* **BL** = Blue **RD** = Red **AM** = Amber*		**24** = 24V DC

*Special Order Option. Consult factory for lead time and MOQ.

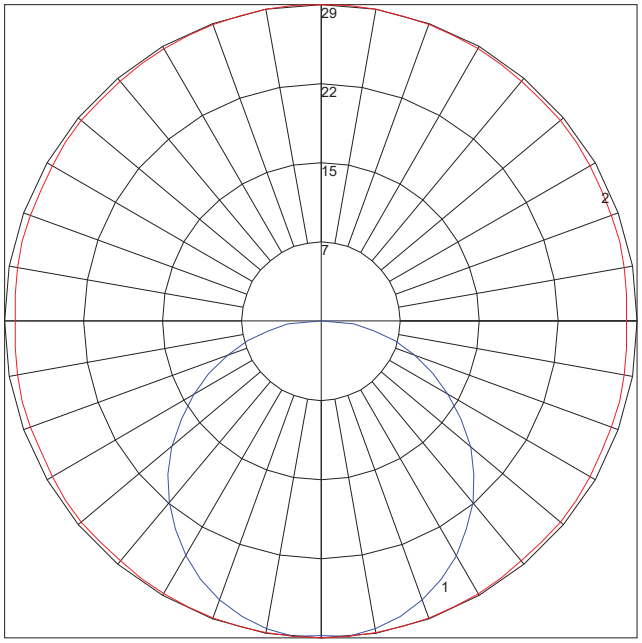
Specifications

Output (2700K)			
LED Intensity	**Low Output**	**Standard Output**	**High Output**
Lumens (lm/ft)	48	96	144
Beam Angle	124.4°		
Efficacy (lm/W)	32		
LEDs	2835		
CRI	>80		
Electrical			
Dimming	TRIAC, ELV, MLV, 0-10V, DMX		
Input Voltage	24V DC		
Power Consumption (W/ft)	1.5	3	4.5
Maximum Run	58′	29′	19′
Physical			
Dimensions	15/32″ X 13/16″		
Cutting Increments	1.97″		
Material	UV, Solvent, Saltwater resistant silicone		
Wire Exit Options	Front, Side, Bottom		
LED PIN Temperature	65°C / 149°F		
Storage Temperature	-25°C / -13°F - 60°C / 140°F		
Ambient Temperature	Ta_{min} = 33°C / 90°F, Ta_{max}		
Certification and Testing			
Certification	UL		
Environment	Wet Location		
IP Rating	IP67		
IK Rating	IK07		
Warranty	3 Years		

- Maximum Run length refers to single side feed in serial connection
- The given color temperature is the strip (after coating) color temperature
- The given data are typical values due to the tolerances of the production process and electrical components; values for the light output and electrical power can vary up to 10%

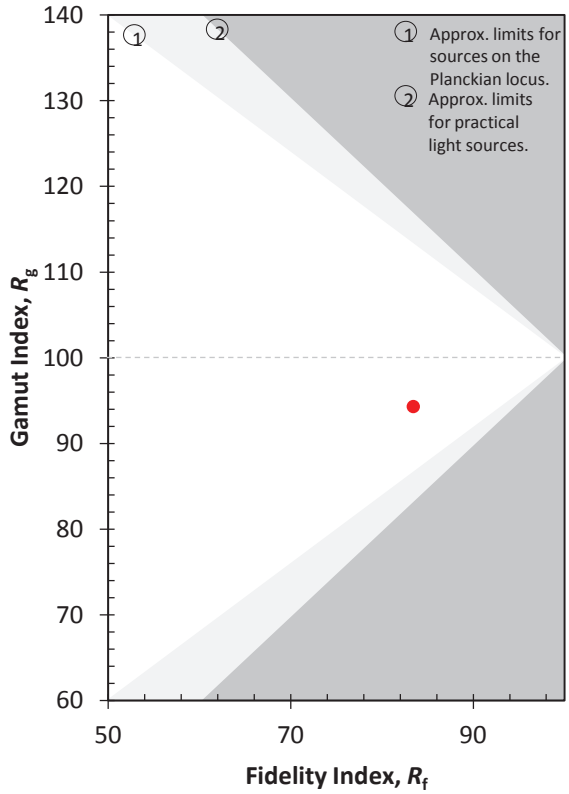
Photometrics

TRACE Horizontal: Based on 2700K



Maximum Candela = 29.44
Located At Horizontal Angle = 85
Vertical Angle = 5
#1 Vertical Plane Through Horizontal Angles (85-265) (Through Max. Cd.)
#2 Vertical Cone Through Vertical Angle (5) (Through Max. Cd.)

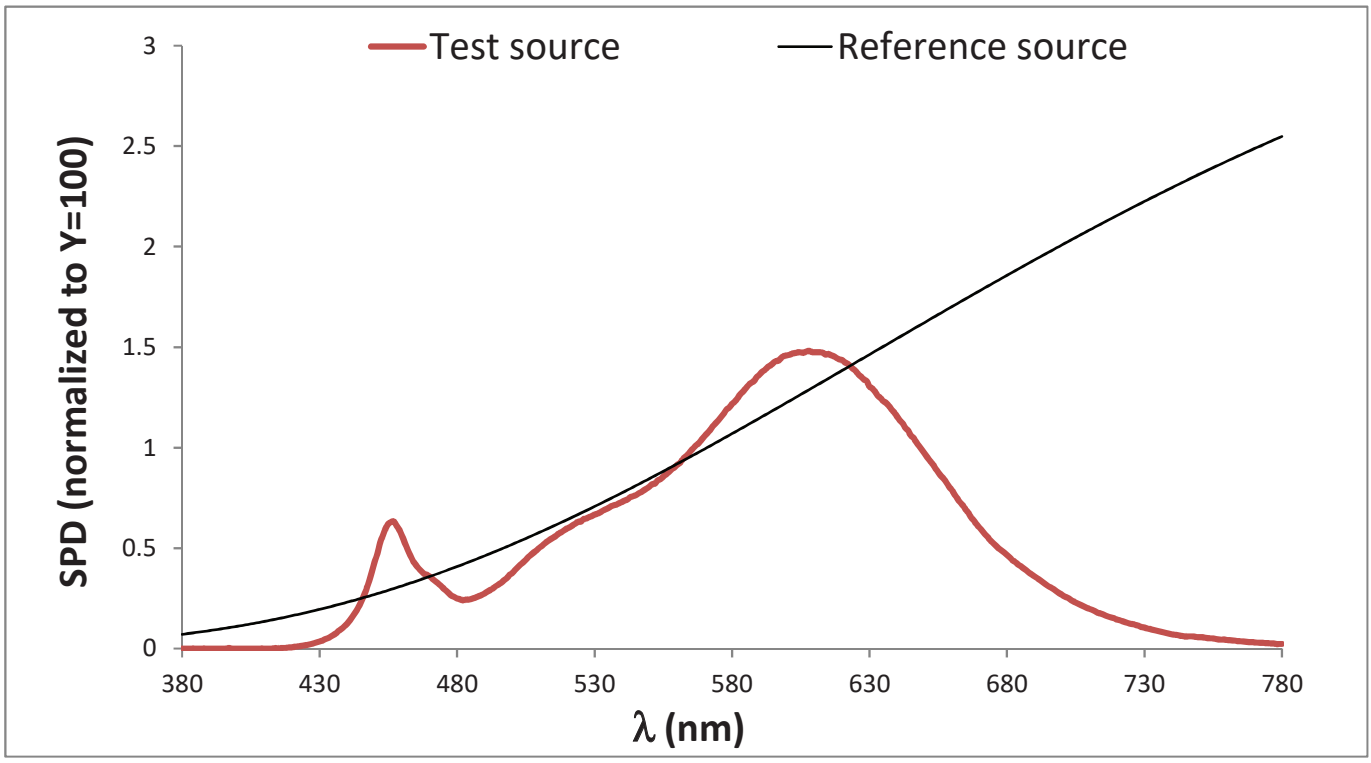
TM-30



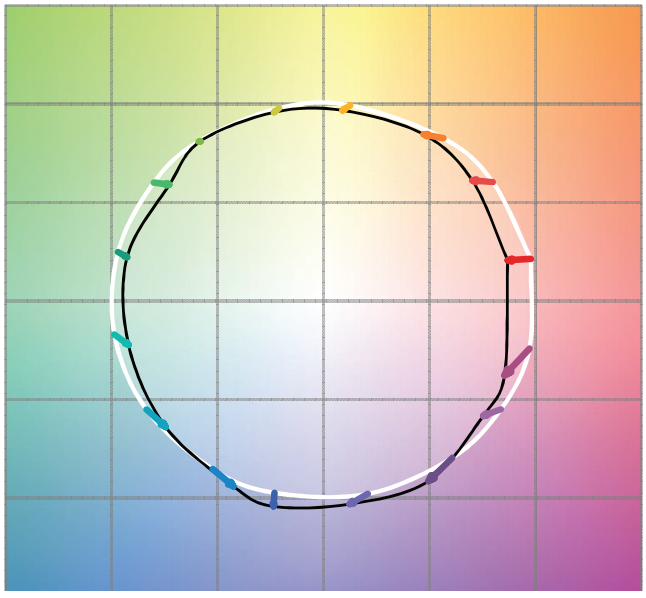
		Graphic shifts (%)	
Hue Bin	R_f	Chroma	Hue
1	78	-11%	1%
2	81	-7%	6%
3	80	-4%	9%
4	89	-3%	3%
5	93	-1%	3%
6	95	0%	0%
7	89	-5%	-3%
8	91	-5%	2%
9	84	-5%	6%
10	79	-3%	12%
11	81	2%	13%
12	84	7%	1%
13	85	3%	-9%
14	78	4%	-16%
15	83	-5%	-7%
16	74	-9%	-15%

TM-30

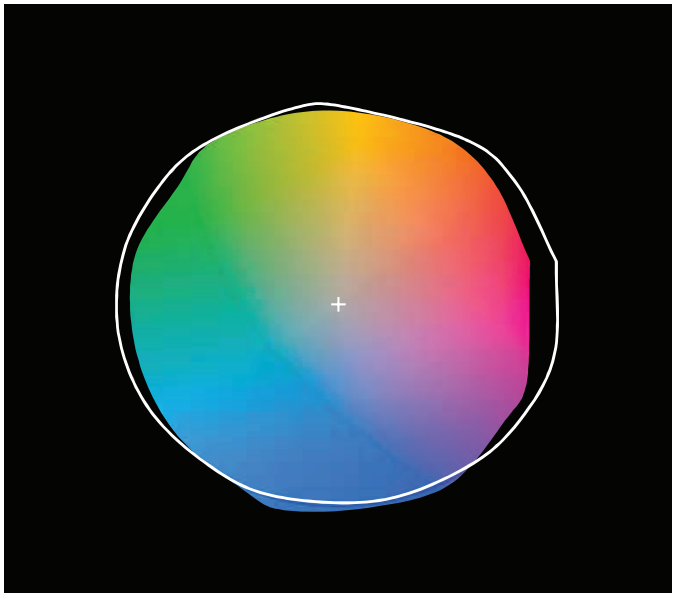
TRACE Horizontal: Based on 2700K



Color Vector Graphic



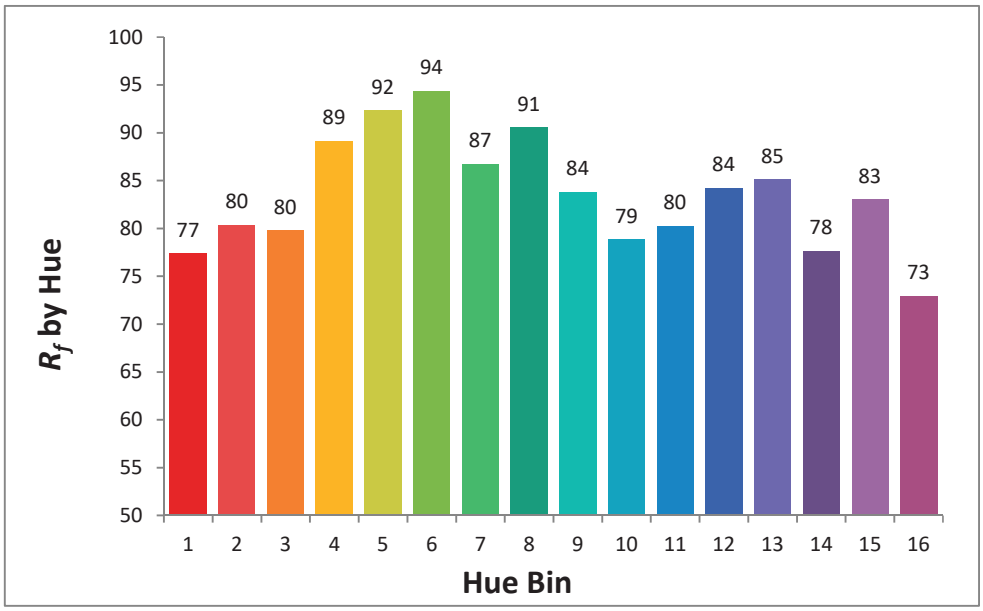
Color Distortion Graphic



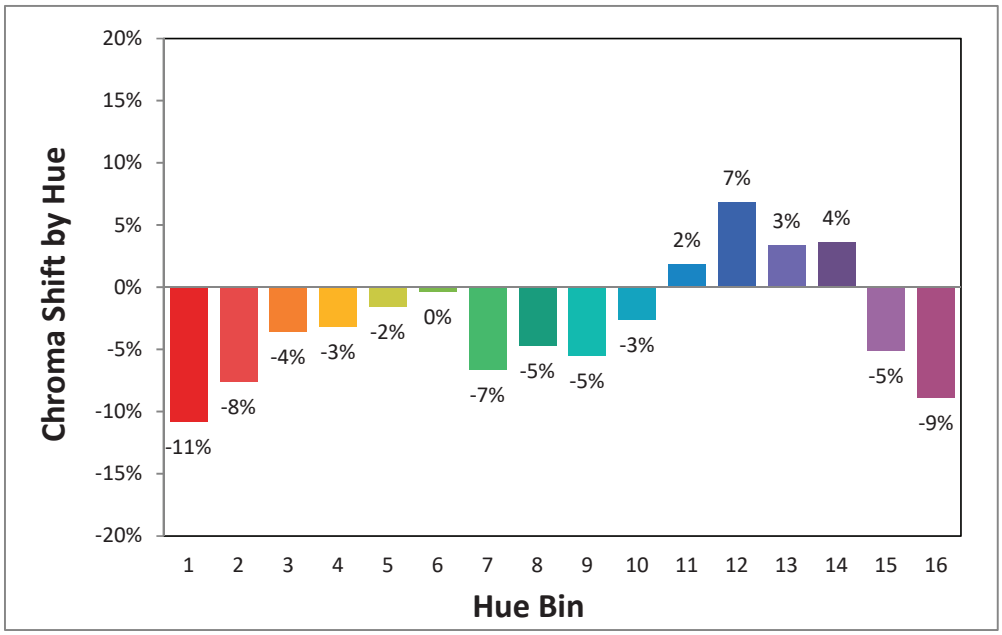
TM-30

TRACE Horizontal: Based on 2700K

Hue Angle Bin vs. Fidelity Index

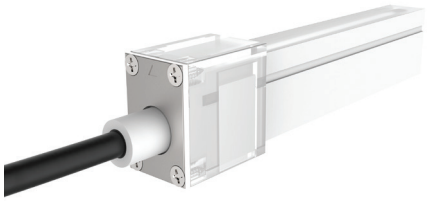


Hue Angle Bin vs. Change of Chroma



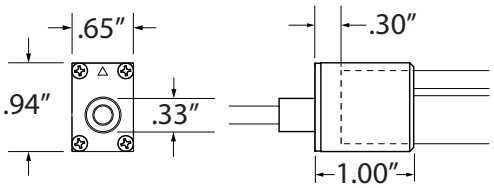
Power Lead Options - Horizontal

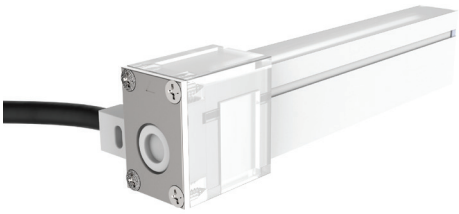
IP67: Rated for outdoor use and factory assembled.
Note: The end cap is made of UV stabilized polycarbonate, which produces no yellowing and cracking over time.



TRACE LEAD - FRONT

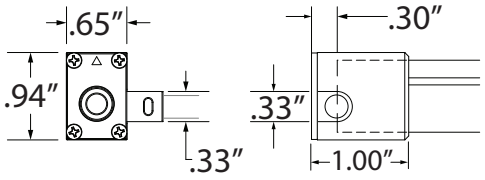
Horizontal Front Lead Entry
5' Power Lead Cable with End Cap





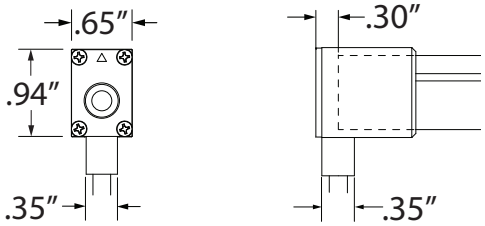
TRACE LEAD - SIDE

Horizontal Side Lead Entry
5' Power Lead Cable with End Cap



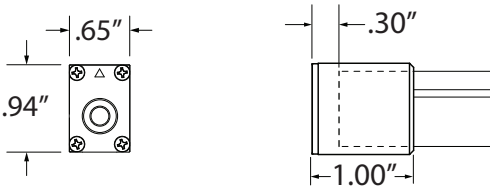
TRACE LEAD - BOTTOM

Horizontal Bottom Lead Entry
5' Power Lead Cable with End Cap



TRACE END CAP

Horizontal End Cap (No Lead)
1 pc End Cap with 4 Screws

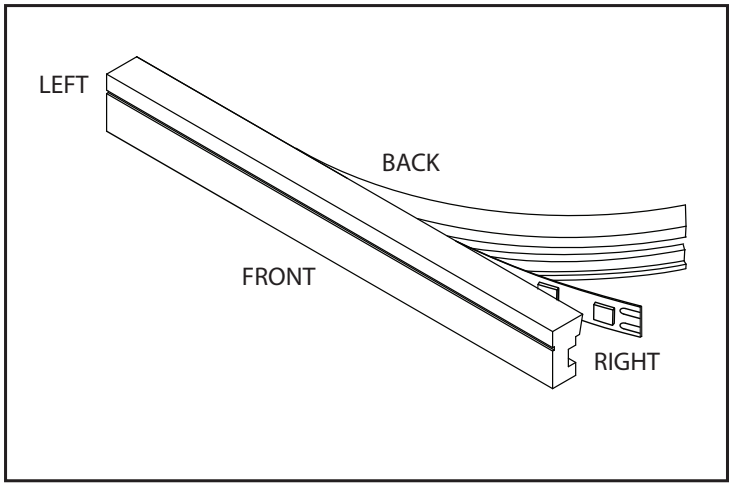


Power Leads - How to Configure

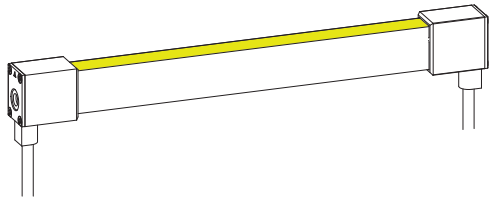
It is important to note the orientation of TRACE and what is considered Left Facing and Right Facing. TRACE is polarity specific and proper submission of power leads for each run is necessary for factory prep standards.

HORIZONTAL TRACE - The cut window will always indicate as Back (Image A).

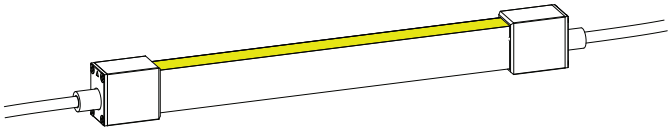
A



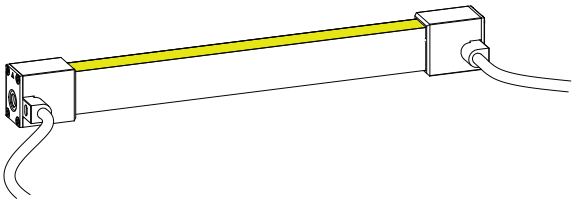
Power Lead Configurations



TRCE-H-LEAD-B-B
Left Facing Bottom Lead with 5' Power Cable to Right Facing Bottom Lead with 5' Power Cable

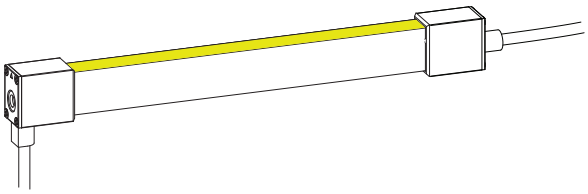


TRCE-H-LEAD-F-F
Left Facing Front Lead with 5' Power Cable to Right Facing Front Lead with 5' Power Cable

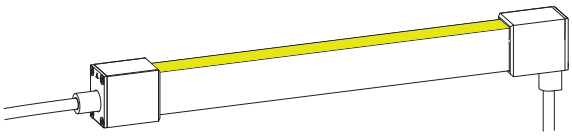


TRCE-H-LEAD-S-S
Left Facing Side Lead with 5' Power Cable to Right Facing Side Lead with 5' Power Cable

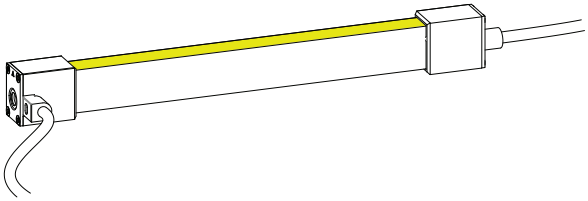
Power Lead Configurations



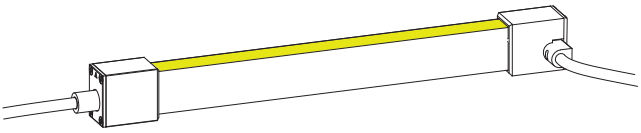
TRCE-H-LEAD-B-F
Left Facing Bottom Lead with 5′ Power Cable to
Right Facing Front Lead with 5′ Power Cable



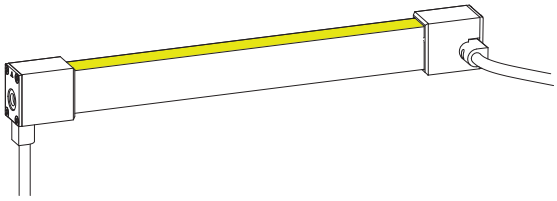
TRCE-H-LEAD-F-B
Left Facing Front Lead with 5′ Power Cable to
Right Facing Bottom Lead with 5′ Power Cable



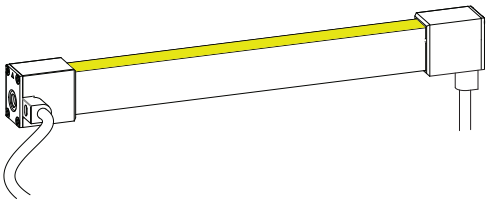
TRCE-H-LEAD-S-F
Left Facing Side Lead with 5′ Power Cable to
Right Facing Front Lead with 5′ Power Cable



TRCE-H-LEAD-F-S
Left Facing Front Lead with 5′ Power Cable to
Right Facing Side Lead with 5′ Power Cable

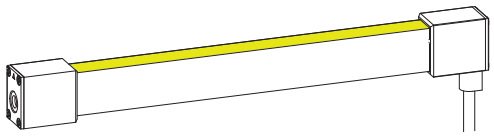


TRCE-H-LEAD-B-S
Left Facing Bottom Lead with 5′ Power Cable to
Right Facing Side Lead with 5′ Power Cable

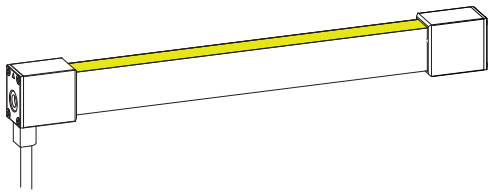


TRCE-H-LEAD-S-B
Left Facing Side Lead with 5′ Power Cable to
Right Facing Bottom Lead with 5′ Power Cable

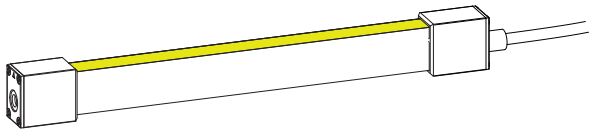
Power Lead Configurations



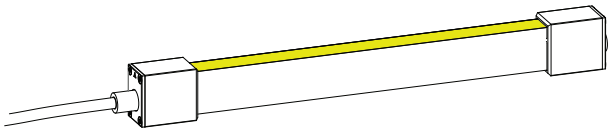
TRCE-H-LEAD-E-B
Left End Cap Lead to Right Facing Bottom Lead with 5′ Power Cable



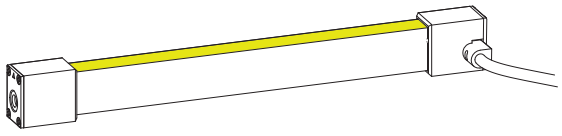
TRCE-H-LEAD-B-E
Left Facing Bottom Lead with 5′ Power Cable to Right End Cap



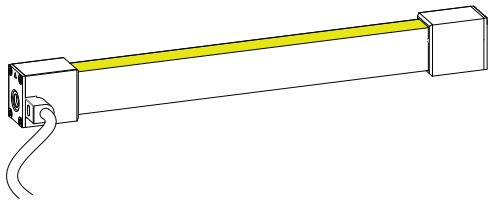
TRCE-H-LEAD-E-F
Left End Cap Lead to Right Facing Front Lead with 5′ Power Cable



TRCE-H-LEAD-F-E
Left Facing Front Lead with 5′ Power Cable to Right End Cap

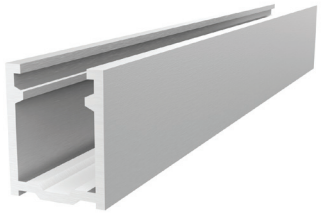


TRCE-H-LEAD-E-S
Left Facing End Cap Lead to Right Facing Side Lead with 5′ Power Cable

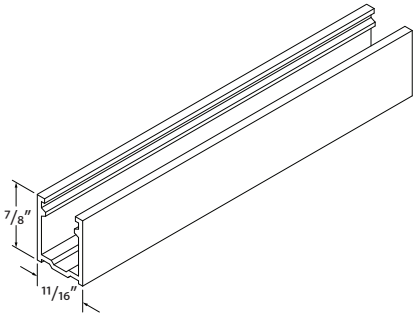


TRCE-H-LEAD-S-E
Left Facing Side Lead with 5′ Power Cable to Right Facing End Cap

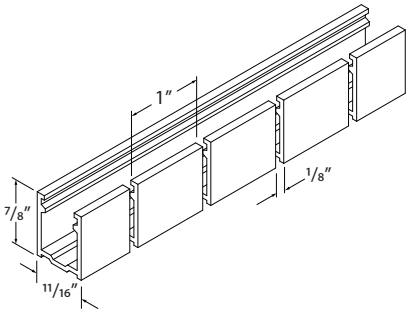
Mounting Options

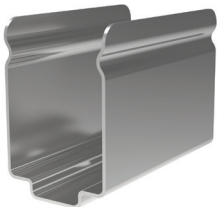


TRCE-H-SLV-SCHAN-6.5
Straight Channel
Horizontal Profile Only
6.56' Length, Aluminum

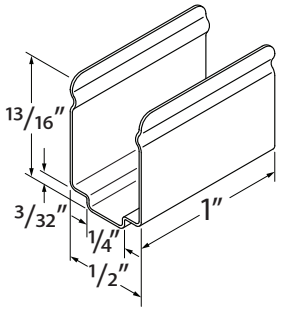


TRCE-H-SLV-NCHAN-6.5
Notched Channel
Horizontal Profile Only
Radius Bend: 11"
6.56' Length, Aluminum





TRCE-H-SLS-MTCLIPS
Mounting Clips
Horizontal Profile Only
2 Stainless Steel Clips with 2 Screws

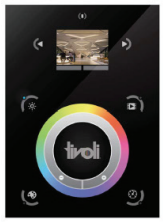


FLXD-SIL-GE-10
GE Silicone 10oz Tube
Use to adhere TRACE into entire run length of channel
25' estimated bead length per 10oz tube

www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

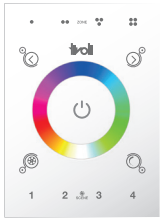
Controls & Software

CONTROLS



TVOQ-10-XX-7
XX = BK (black), WH (white)
1024 DMX channel, 500 scene,
10 zone, glass touch screen

TVOQ-2-XX
XX = BK (black), WH (white)
512 DMX channel, 99 scene,
1 zone, glass touch screen



TVOQ-1-WHT
512 DMX channel, 16 scene,
4 zone, glass touch screen

SOFTWARE

Cue™ and CuePro™ softwares are specifically designed for the TivoCUE™ in-wall DMX controls and includes an array of tools required by the latest DMX lighting fixtures. Intuitive, with easy-to-use effects that can be dropped into timelines, and multi-zone synchronization capabilities allow you to program a project effortlessly.

Power Supplies - Indoor

ADUL - NON DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-D	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-D				2	2x96W	2x4A
	ADUL-320-3-4-24-D				3	3x96W	3x4A

ADUL - 0-10V DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DOT	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-DOT				2	2x96W	2x4A
	ADUL-320-3-4-24-DOT				3	3x96W	3x4A

ADUL - DMX SINGLE ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DIN	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-DIN				2	2x96W	2x4A
	ADUL-320-3-4-24-DIN				3	3x96W	3x4A

ADUL - DMX MULTI ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-240-2-4-24-DIN-2	Indoor / Damp	100-277V AC 5o/60 Hz	24V DC	2	2x96W	2x4A
	ADUL-320-3-4-24-DIN-3				3	3x96W	3x4A

Power Supplies - Outdoor

ADNM - NON DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-D	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-D				1	96W	4A
	ADNM-240-2-4-24-D				2	2x96W	2x4A
	ADNM-320-3-4-24-D				3	3x96W	3x4A

ADNM - 0-10V DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-DOT	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-DOT				1	96W	4A
	ADNM-240-2-4-24-DOT				2	2x96W	2x4A
	ADNM-320-3-4-24-DOT				3	3x96W	3x4A

ADNM - DMX SINGLE ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-DIN	Indoor / Outdoor	100-277V AC 5o/60 Hz	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-DIN				1	96W	4A
	ADNM-240-2-4-24-DIN				2	2x96W	2x4A
	ADNM-320-3-4-24-DIN				3	3x96W	3x4A

ADNM - DMX MULTI ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-240-2-4-24-DIN-2	Indoor / Outdoor	100-277V AC 5o/60 Hz	24V DC	2	2x96W	2x4A
	ADNM-320-3-4-24-DIN-3				3	3x96W	3x4A

ADNM - DMX/DALI FLICKER-FREE FOR TV STUDIO

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-120-1-4-24-DTV	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	1x96W	1x4A
	ADNM-240-2-4-24-DTV				2	2x96W	2x4A
	ADNM-320-3-4-24-DTV				3	3x96W	3x4A

Dimmers

DIMMING - 0-10V

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
0-10V Dimmer	DIM-LD-010	Indoor	12V/24V DC	12V/24V DC	30 mA max. output (sink only)

DIMMING - MLV

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
MLV Dimmer	N-600	Indoor	120V AC	120V AC	450W
	N-1000				800W
	N-1500				1200W
	D-600				450W
	M-600				450W
	M-1000				800W

DIMMING - ELV

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
ELV Dimmer	ME-600	Indoor	120V AC	120V AC	450W
	DE-300				300W

www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

ELT-03

Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

Maximum Candela = 52.6 at 90 H 2.5 V

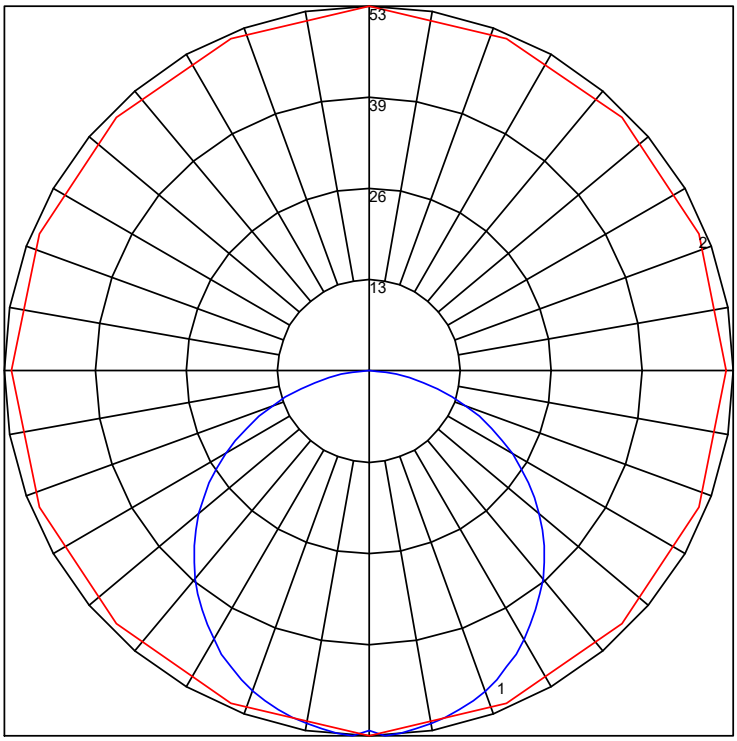
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

Polar Candela Curves:

Vertical Plane Through:
1) 90 - 270 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



ELT-03

Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

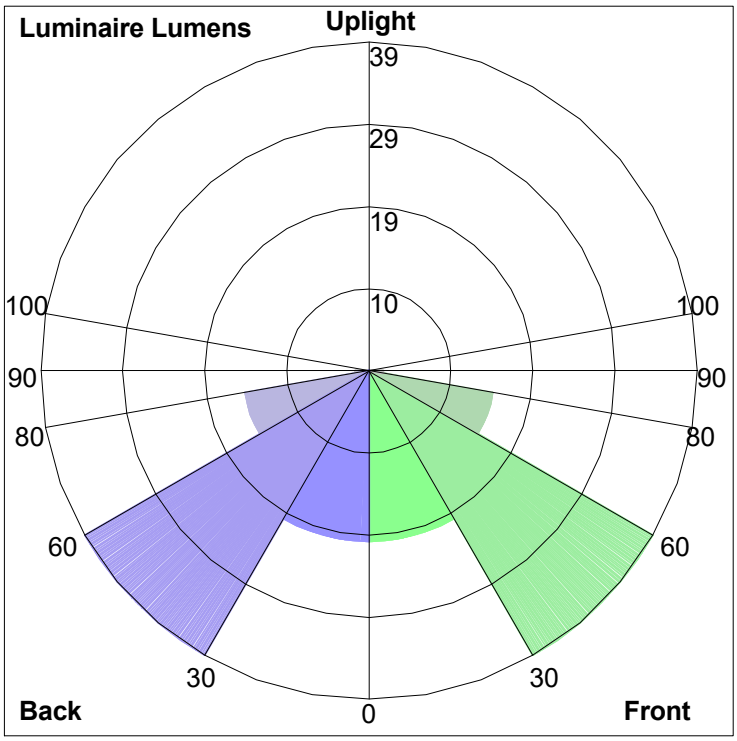
Maximum Candela = 52.6 at 90 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	20.1	N.A.	13.3
FM (30-60)	38.8	N.A.	25.7
FH (60-80)	14.9	N.A.	9.9
FVH (80-90)	1.7	N.A.	1.1
BL (0-30)	20.1	N.A.	13.3
BM (30-60)	38.8	N.A.	25.7
BH (60-80)	14.9	N.A.	9.9
BVH (80-90)	1.7	N.A.	1.1
UL (90-100)	0.0	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	151.0	N.A.	100.0
BUG Rating	B0-U0-G0		



ELT-03A

Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

Maximum Candela = 52.6 at 90 H 2.5 V

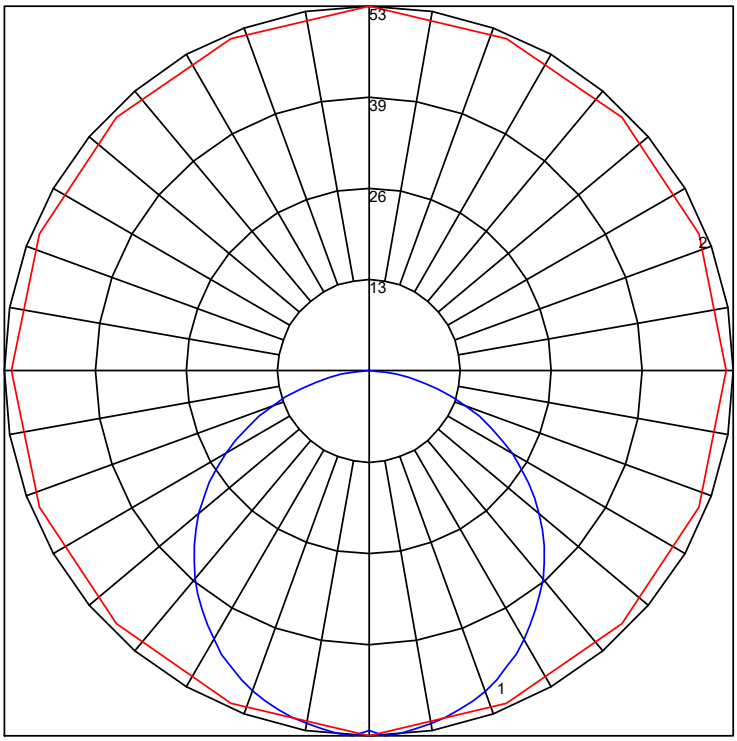
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

Polar Candela Curves:

Vertical Plane Through:
1) 90 - 270 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



ELT-03A

Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

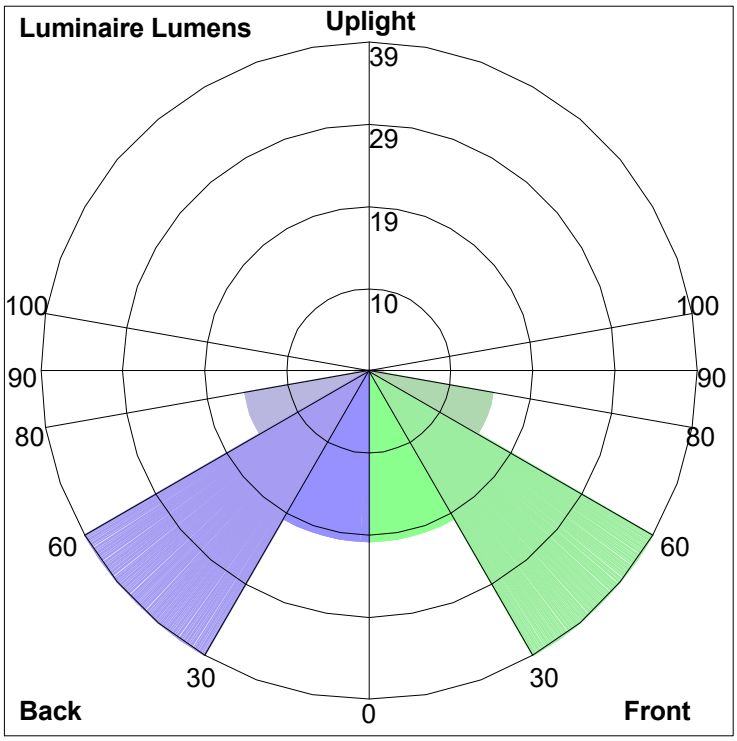
Maximum Candela = 52.6 at 90 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	20.1	N.A.	13.3
FM (30-60)	38.8	N.A.	25.7
FH (60-80)	14.9	N.A.	9.9
FVH (80-90)	1.7	N.A.	1.1
BL (0-30)	20.1	N.A.	13.3
BM (30-60)	38.8	N.A.	25.7
BH (60-80)	14.9	N.A.	9.9
BVH (80-90)	1.7	N.A.	1.1
UL (90-100)	0.0	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	151.0	N.A.	100.0
BUG Rating	B0-U0-G0		



Received
By PCM3 at 12:54 pm, April 27, 2023

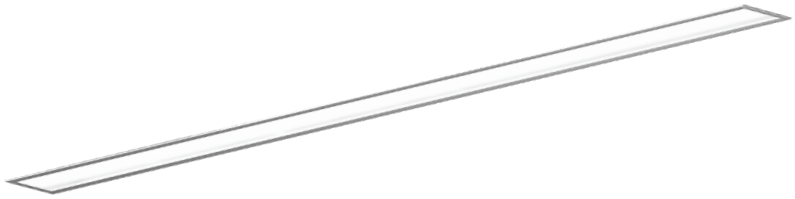
Date: _____ Customer: _____

Project: Compton College -VAPA

Type: ELT-4 / ELT- 4A / ELT-4B Qty: _____

selux

M60 LED H_2O Recessed
for Wet Locations
(IP65 rated geartray and driver)



Order Code: _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - CN22xxxx

_____	**Series**	**W60** M60 LED H_2O Multi-Mount Form for Wet Location **W6R1** M60 LED H_2O Continuous Flange (Flanged Endcaps) for Wet Location **W6R2** M60 LED H_2O Continuous Flange (Flangeless Endcaps) for Wet Location	
_____	**Light Engine**	**1C45** 80CRI-848lm 90CRI-712lm 11.1W per foot **1C40** 80CRI-794lm 90CRI-668lm 9.9W per foot **1C35** 80CRI-694lm 90CRI-584lm 8.7W per foot **1C30** 80CRI-621lm 90CRI-522lm 7.3W per foot **1C25** 80CRI-495lm 90CRI-416lm 6.1W per foot **1C20** 80CRI-411lm 90CRI-346m 4.9W per foot	*Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2.
_____	**CCT**	**935** 3500K 90 CRI nominal **940** 4000K 90 CRI nominal **950** 5000K 90 CRI nominal **955** 5500K 90 CRI nominal **835**[1] **840**[1] **850**[1] **855**[1]	* See page 2 for details on CCT and CRI [1] Consult factory
_____	**Shielding**	**LW** LED Optimized White Lens **MI** Clear Lens with Microprism **NB** LMO Symmetric with Satine Lens **A2** LMO Asymmetric 20° Wall Washer with Satine Lens **A5** LMO Asymmetric 5° Wall Grazer with Satine Lens **BW** LMO Batwing with Satine Lens	
_____	**Mounting W60** or **Mounting W6R1 or W6R2**	**SF1** Spackle Flange (½" Drywall) **SF2** Spackle Flange (⅝" Drywall) **SF3** Spackle Flange (After Drywall) **SG** Slot Grid (9/16") (Wire Suspension or ¼"-20 stud) **DC** Decoustic Ceiling (up to 2" thick) **TB**[2] T-Bar Length with suspension clips **TBS**[2] T-Bar Length with 1" ¼"-20 Stud **RC**[2] Rotating Crossbar (Ceilings ¼" to 2" thick) **TS** 1" ¼"-20 Stud	[2] L6R1 only
_____	**Nominal Fixture Length**	**02**[3] 2 ft. **03** 3 ft. **04**[3] 4 ft. **05**[3] 5 ft. **06**[3] 6 ft. **07** 7 ft. **08**[3] 8 ft. **XX** Runs (over 8') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 09=09' nominal) *Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.*	[3] Length intended to fit centered between the grid for SG, TB, TBS mountings
_____	**Finish**	**WH** White **BL** Semi-Matte Black **SV** Silver **SP** Specify Premium Color	** Custom colors are available, please consult factory*
_____	**Voltage**	**1** 120V **2** 277V **U** 120V through 277V 50/60hz capable	
_____	**Driver**	**DM10** 0-10V 10% (Linear)	* See page 7 for full details
_____	**Fixture Options**	**SS**[4] Separate Switching **CCEA** CCEA approved	[4] See page 10 for details
_____	**Emergency Options**	**EC**[5] Emergency Circuit Wiring **EMR** Remote Micro Inverter (consult factory)	[5] See page 10 for full details and restrictions
_____	**Configuration Options**	**L9** Lit Horizontal 90° Corner **V9** Lit Inverted 90° Corner **T9** Lit "T" section **X9** Lit "X" section	*See pages 12 for full details and restrictions
CN22xxxx		**CN22xxxx:** M60 LED with IP65 rated LED engine and IP rated driver	

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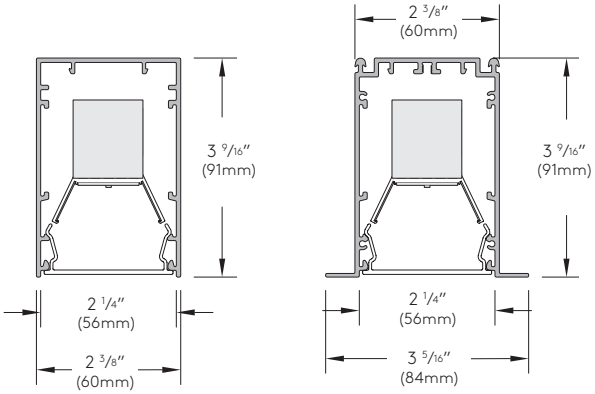


LW lens shown for reference

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 8') or Runs.

Flange (W6R1 or W6R2 Series) - 9/16" (14mm) wide flange runs full lengths of both sides and is part of the main extruded body. Specify continuous flange (W6R1) or flush (W6R2) end cap. W6R2 does not work in T-Bar ceiling.

Geartray - Low copper 6063-T6 extruded aluminum profile. Geartray and connections encased in silicone for IP65 rating.

Shielding - Extruded, impact resistant acrylic snap in lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - Spackle-in (drywall), Slot grid, Decoustic, T-bar grid, Rotating Crossbar and Threaded Stud Mountings (see pages 3 through 6 for details).

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately 1/4" increments starting at the nominal 8' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with you requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaires.

W60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied W60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 8 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 11 for details.

CCT - Available in four CCTs. LEDs have a color shift due to the silicone encapsulation, and the delivered nominal CCTs are listed below.

CRI - 90 CRI standard, consult factory 80 CRI.

CRI / CCT	Nominal CCT
935	3500K
940	4000K
950	5000K
955	5500K

All Drivers - IP66 rated driver - constant current, Class 2 with a PFC>0.99. For more detailed information on the driver please see page 7.

Emergency - Emergency Circuit and Remote Micro Inverter. For more details on EC, see page 8.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for ambient temperatures of -40°C (-40°F) to 40°C (104°F).

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

Warranty:

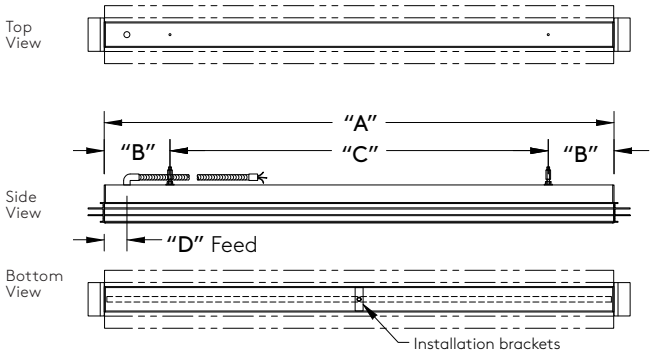
5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

Certifications and Compliance:

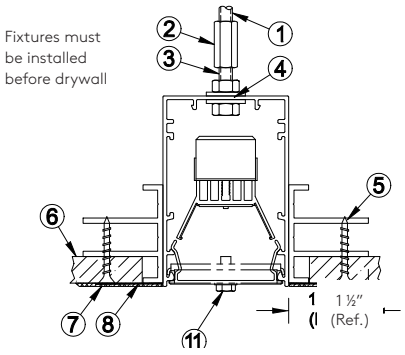
NRTL - For Wet location
(I.E. cULus; cCSAus)
ARRA Compliant
RoHS Compliant
IC Rated (EM option is non-IC Rated)

selux

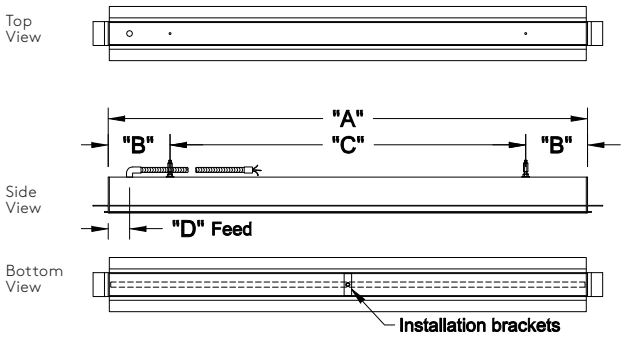
½" Spackle Flange Mounting (SF1)



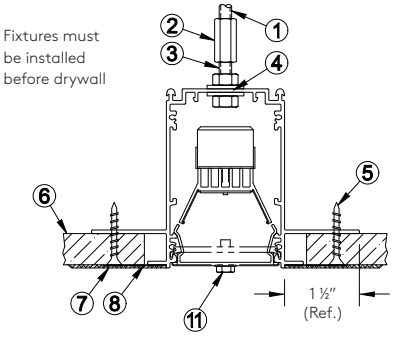
½" Spackle Flange Mounting (SF1)



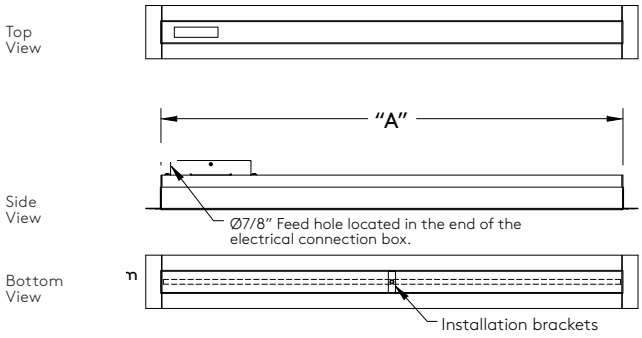
⅝" Spackle Flange Mounting (SF2)



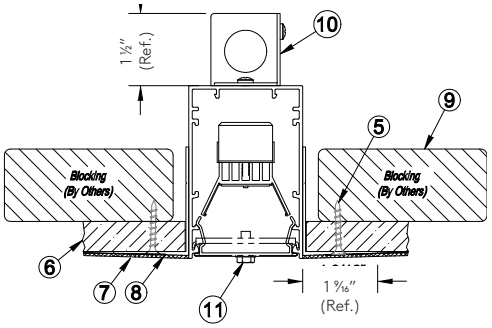
⅝" Spackle Flange Mounting (SF2)



After Drywall Flange Mounting (SF3)



After Drywall Flange Mounting (SF3)

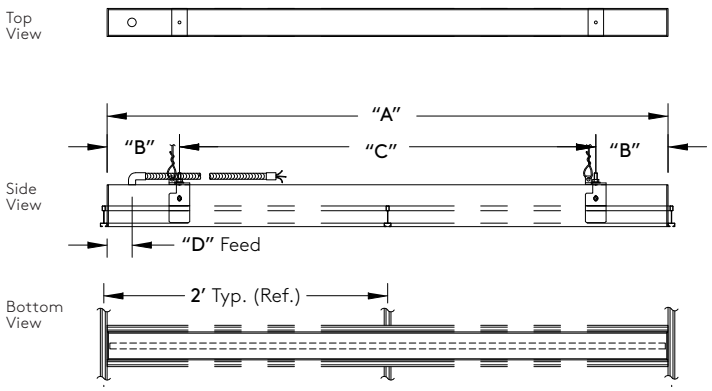


Spackle Flange Mounting (SF1, SF2 and SF3) - Dimensions								
Nominal Length	**"A" O.A.L. without Flange**		**"B" End Suspensions**		*** "C" Mid Suspension**		**"D" Feed Location**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2 ft.)	2' - ¼''	616	0' -1 ⅝''	41	1' - 9''	533	0' - 4 ⅛''	105
03 (3 ft.)	3' - ¼''	921	0' -6 ⅛''	156	2' - 0''	609	0' - 2 ⅛''	54
04 (4 ft.)	4' - ¼''	1226	0' -6 ⅛''	156	3' - 0''	914	0' - 2 ⅛''	54
05 (5 ft.)	5' - ¼''	1530	0' -6 ⅛''	156	4' - 0''	1219	0' - 2 ⅛''	54
06 (6 ft.)	6' - ¼''	1835	0' -6 ⅛''	156	5' - 0''	1524	0' - 2 ⅛''	54
07 (7 ft.)	7' - ¼''	2140	0' -6 ⅛''	156	6' - 0''	1829	0' - 2 ⅛''	54
08 (8 ft.)	8' - ¼''	2445	0' -6 ⅛''	156	7' - 0''	2134	0' - 2 ⅛''	54

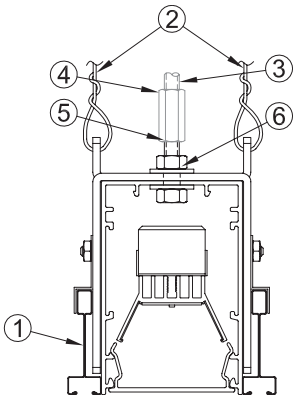
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to struture (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. Drywall/Drywall screw (Ref.)
6. Drywall/Drywall (Ref.)
7. ⅛" Plaster skimcoat (Ref.)
8. Drywall/Drywall tape (Ref.)
9. Blocking to secure fixture (by others)
10. Electrical connection box, removable side cover for electrical connection pre-installation, once installed the wiring is accessible from below the ceiling through the luminaire.
11. Luminaires ship with the brackets pre-installed.
    - The brackets cannot be removed until the fixture is completely installed and secured through the spackle flange.
    - Once the brackets are removed, the lens can be installed.

Slot Grid Mounting (SG)



9/16" Slot Grid Mounting (SG)
(Wire Suspension or 1/4"-20 Stud)

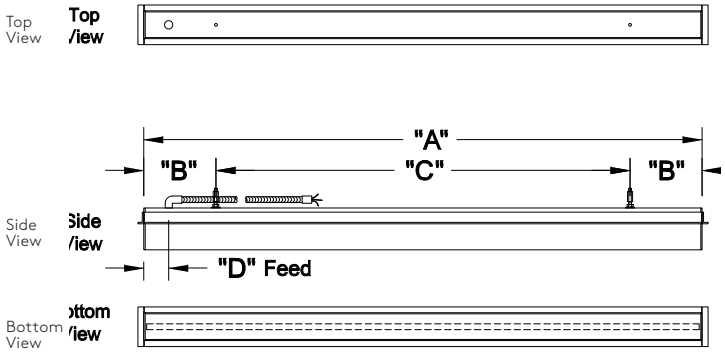


1. 9/16" Slot grid (shown as Ref.)
2. Support wire to structure (supplied and installed by others).
3. 1/4"-20 Threaded rod to structure (supplied and installed by others).
4. 1/4"-20 Coupler hardware (supplied and installed by others).
5. 1" 1/4"-20 Stud (by Selux).
6. Ø5/16" (Ø7mm) mounting hole.

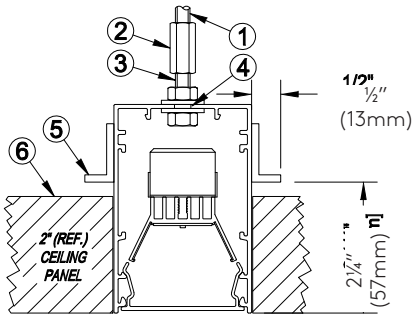
Slot Grid Mounting (SG) - Dimensions									
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" Mid Suspension		"D" Feed Location		"E" Grid Spacing
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	
02 (2 ft.)	1' - 11 5/16"	592	0' -1 5/8"	41	1' - 5 3/16"	437	0' - 1 1/8"	29	2' Center to Center
04 (4 ft.)	3' - 11 5/16"	1202	0' - 6 1/8"	156	2' - 11 3/16"	894	0' - 2 1/8"	54	4' Center to Center
05 (5 ft.)	4' - 11 5/16"	1507	0' - 6 1/8"	156	3' - 11 3/16"	1199	0' - 2 1/8"	54	5' Center to Center
06 (6 ft.)	5' - 11 5/16"	1811	0' - 6 1/8"	156	5' - 11 3/16"	1504	0' - 2 1/8"	54	6' Center to Center
08 (8 ft.)	7' - 11 5/16"	2421	0' - 6 1/8"	156	6' - 11 3/16"	2113	0' - 2 1/8"	54	8' Center to Center

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Decoustic Mounting (DC)



Decoustic Mounting (DC)
(Panels up to 2" thick)



Decoustic Mounting (DC) - Dimensions								
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" Mid Suspension		"D" Feed Location	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
02 (2 ft.)	2' - 1/4"	616	1 5/8"	41	1' - 9"	533	0' - 4 1/8"	105
03 (3 ft.)	3' - 1/4"	921	6 1/8"	156	2' - 0"	609	0' - 2 1/8"	54
04 (4 ft.)	4' - 1/4"	1226	6 1/8"	156	3' - 0"	914	0' - 2 1/8"	54
05 (5 ft.)	5' - 1/4"	1530	6 1/8"	156	4' - 0"	1219	0' - 2 1/8"	54
06 (6 ft.)	6' - 1/4"	1835	6 1/8"	156	5' - 0"	1524	0' - 2 1/8"	54
07 (7 ft.)	7' - 1/4"	2140	6 1/8"	156	6' - 0"	1829	0' - 2 1/8"	54
08 (8 ft.)	8' - 1/4"	2445	6 1/8"	156	7' - 0"	2134	0' - 2 1/8"	54

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

1. 1/4"-20 Threaded rod to structure (supplied and installed by others).
2. 1/4"-20 Coupler hardware (supplied and installed by others).
3. 1" 1/4"-20 Stud (by Selux).
4. Ø5/16" (Ø7mm) mounting hole.
5. 1/2" wide aluminum angle runs the entire length of fixture to block view into plenum area from below fixture.
6. Suitable for Decoustic® ceiling panel installations with panels up to 2" thick (supplied and installed by others). Other ceiling systems possible, please consult factory. Decoustic® is a registered trademark of Decoustics Ltd. Corporation.

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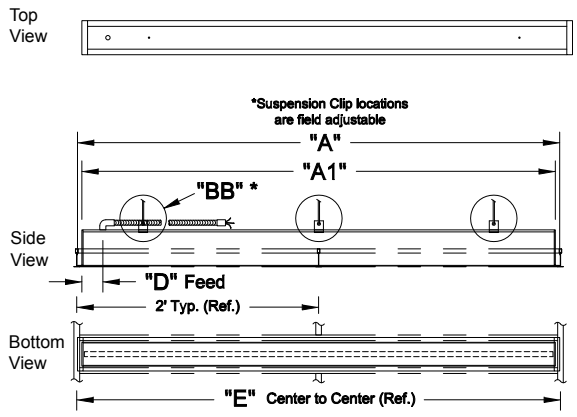
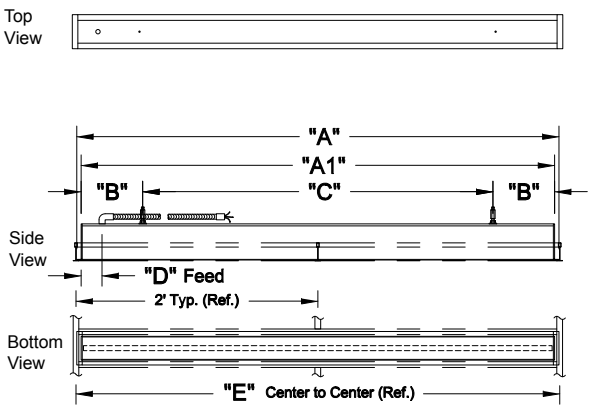
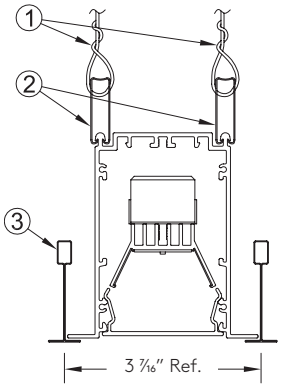
T-Bar Mounting (TB)



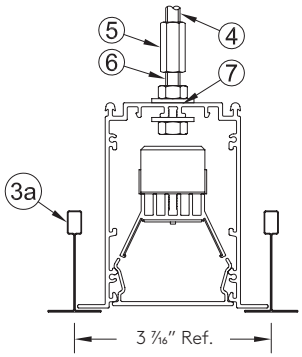
T-Bar with Stud Mounting (TBS)



T-Bar with Suspension Clips (TB)
(9⁄16" or 15⁄16" grid)



T-Bar with ¼"-20 Stud (TBS)
(9⁄16" or 15⁄16" grid)



1. Support wire to structure (supplied and installed by others).
2. Spring steel suspension clips located approximately every 4 ft. (supplied by Selux).
3. 9⁄16" T-bar grid (shown as Ref.)
3a. 15⁄16" T-bar grid (shown as Ref.)
4. ¼"-20 Threaded rod to structure (supplied and installed by others).
5. ¼"-20 Coupler hardware (supplied and installed by others).
6. 1" ¼"-20 Stud (by Selux).
7. Ø5⁄16" (Ø7mm) mounting hole.

T-Bar (TB and TBS) - Dimensions														
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		**"BB" (TB mtg.) Suspension Clips**	*** "C" Mid Suspension**		**"D" Feed Location**		**"E" Grid Spacing**	**"F" Wall Angle**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Quantity**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**		**Feet/Inch**	**mm**
***02 (2 ft.)**	1' - 11 13⁄16"	605	1' - 11"	583	0' - 1 5⁄8"	41	4x	1' - 4 3⁄4"	425	0' - 1 1⁄8"	29	2' Center to Center	1' - 10 3⁄4"	577
***04 (4 ft.)**	3' - 11 13⁄16"	1215	3' - 11"	1193	0' - 6 5⁄8"	156	6x	2' - 10 3⁄4"	882	0' - 2 1⁄8"	54	4' Center to Center	3' - 10 3⁄4"	1187
***05 (5 ft.)**	4' - 11 13⁄16"	1519	4' - 11"	1497	0' - 6 5⁄8"	156	6x	3' - 10 3⁄4"	1187	0' - 2 1⁄8"	54	5' Center to Center	4' - 10 3⁄4"	1491
***06 (6 ft.)**	5' - 11 13⁄16"	1825	5' - 11"	1803	0' - 6 5⁄8"	156	6x	4' - 10 3⁄4"	1492	0' - 2 1⁄8"	54	6' Center to Center	5' - 10 3⁄4"	1787
***08 (8 ft.)**	7' - 11 13⁄16"	2434	7' - 11"	2412	0' - 6 5⁄8"	156	8x	6' - 10 3⁄4"	2101	0' - 2 1⁄8"	54	8' Center to Center	7' - 10 3⁄4"	2406

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.
*For other lengths consult factory

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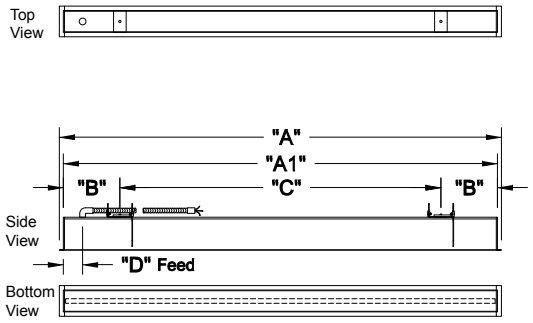
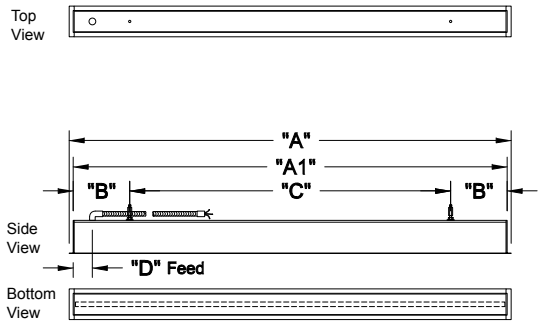
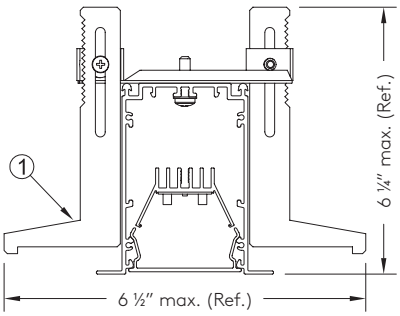
Rotating Crossbar Mounting (RC)



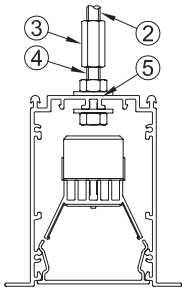
¼"-20 Threaded Stud Mounting (TS)



Rotating Crossbars (RC)
(¼" to 2" thick ceiling)



¼"-20 Threaded Stud (TS)
(1" Threaded Stud)



1. Rotating Crossbar intended for inaccessible ceilings, adjustable for ceiling thickness of ¼" to 2".
2. ¼"-20 Threaded rod to structure (supplied and installed by others).
3. ¼"-20 Coupler hardware (supplied and installed by others).
4. 1" ¼"-20 Stud (by Selux).
5. Ø5⁄16" (Ø7mm) mounting hole.

Rotating Crossbar (RC) and Threaded Stud (TS) - Dimensions												
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		*** "C" Mid Suspension**		**"D" Feed Location**		**"E" Wall Angle**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2 ft.)	2' - 1 1⁄8"	638	2' - ¼"	616	0' - 1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105	2' - 0"	610
03 (3 ft.)	3' - 1 1⁄8"	942	3' - ¼"	921	0' - 6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54	3' - 0"	914
04 (4 ft.)	4' - 1 1⁄8"	1247	4' - ¼"	1226	0' - 6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54	4' - 0"	1219
05 (5 ft.)	5' - 1 1⁄8"	1552	5' - ¼"	1530	0' - 6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54	5' - 0"	1524
06 (6 ft.)	6' - 1 1⁄8"	1857	6' - ¼"	1835	0' - 6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54	6' - 0"	1829
07 (7 ft.)	7' - 1 1⁄8"	2162	7' - ¼"	2140	0' - 6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54	7' - 0"	2134
08 (8 ft.)	8' - 1 1⁄8"	2466	8' - ¼"	2445	0' - 6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54	8' - 0"	2438

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

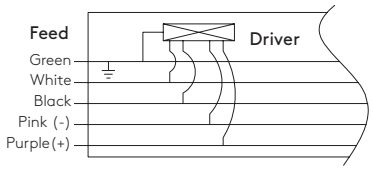
0-10V linear dimming (DM10)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 10%.

* For control recommendations, please contact driver manufacturer.

Driver Quantity							
Light Engine	**2ft**	**3ft**	**4ft**	**5ft**	**6ft**	**7ft**	**8ft**
1C20	1						
1C25	1					1	
1C30	1				1		
1C35	1				1	2	1
1C40	1				1	2	2
1C45	1			2	1	2	

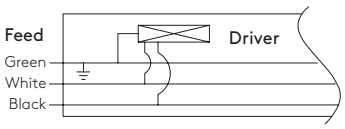
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED ECOdrive (DIL)
DALI-2 logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

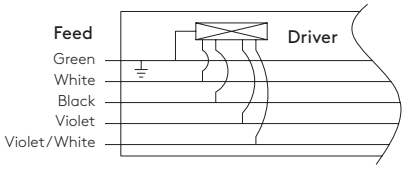


Standard Wiring supplied for all drivers	Green = Ground White = Neutral (120V/277V/347V) or L2 (240V) Black = Hot/L1 (120V-347V)
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED, D01, DL01	Pink = (-) DALI-2 or 0-10V Dimming Control Purple = (+) DALI-2 or 0-10V Dimming Control
DC2	No additional wires
DE1	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)



Lutron EcoSystem (DE1)



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage			
Driver	**Light Engine**	**Nominal W/ft**	
		120V	**277V**
DM10	1C20	4.9	5.3
	1C25	6.1	6.5
	1C30	7.3	7.7
	1C35	8.7	8.9
	1C40	9.9	10.1
	1C45	11.1	11.3

Emergency Wiring (EC) - EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

* For 2' to 6' nominal luminaires, the entire fixture is wired for operation on emergency circuit.

* For 7' and up nominal luminaires, the first 4' nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

* If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

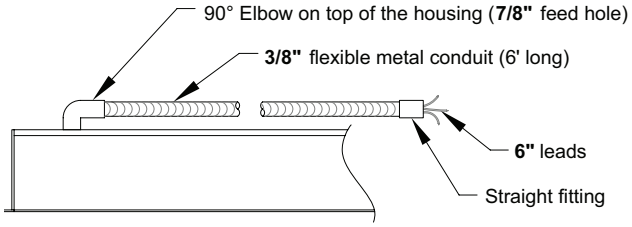
Separate Switching (SS) - Luminaires available with separately switched 4' (nominal) sections starting at 7' and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

* All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

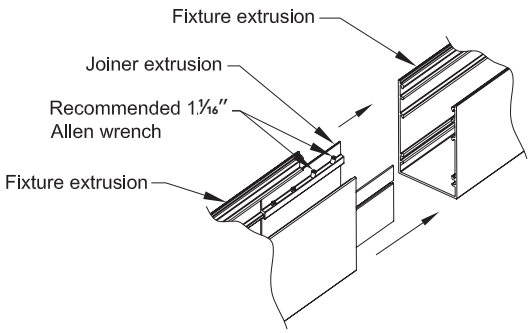
* To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

* If the project requires different separate switching than outlined above please consult the factory.

Flex Whip - standard for recessed fixtures



Joiner System - standard for Runs and Configurations



Standard Recessed (W60) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

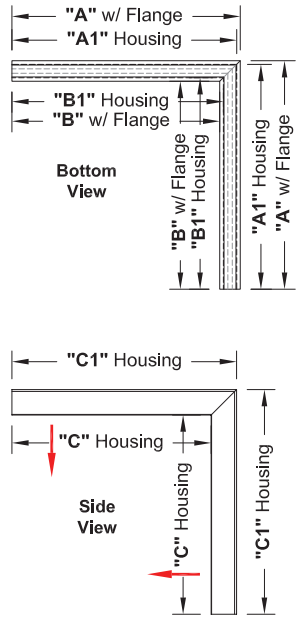
The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

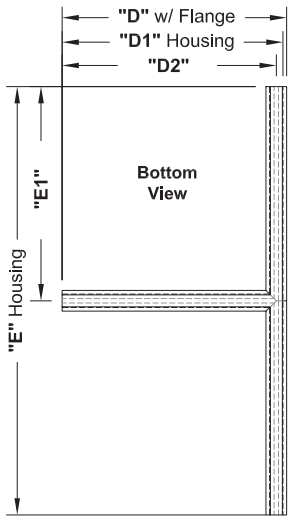
Project Specific Recessed (W60) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

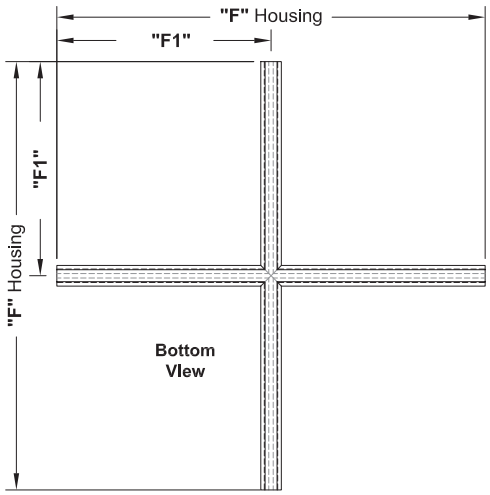
L9 - Lit Horizontal Corner



T9 - Lit "T" Section



X9 - Lit "X" Section



Recessed (W60) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
"A" Housing (Outside)	2' - 1 1/4"	642						
"A1" Housing (Inside)	1' - 10 15/16"	582						
"B" Housing (Outside)			1' - 11 1/2"	597				
"B1" Housing (Inside)			2' - 3 1/16"	688				
"C" Housing (Inside)					2' - 1 1/4"	642		
"C1"					2' - 1/8"	612		
"D" Housing					4' - 3/16"	1224		
* "D1"					2' - 1/8"	612		
"E" Housing							4' - 3/16"	1224
"E1"							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Standard Recessed (W6R1/2) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions please consult the factory.

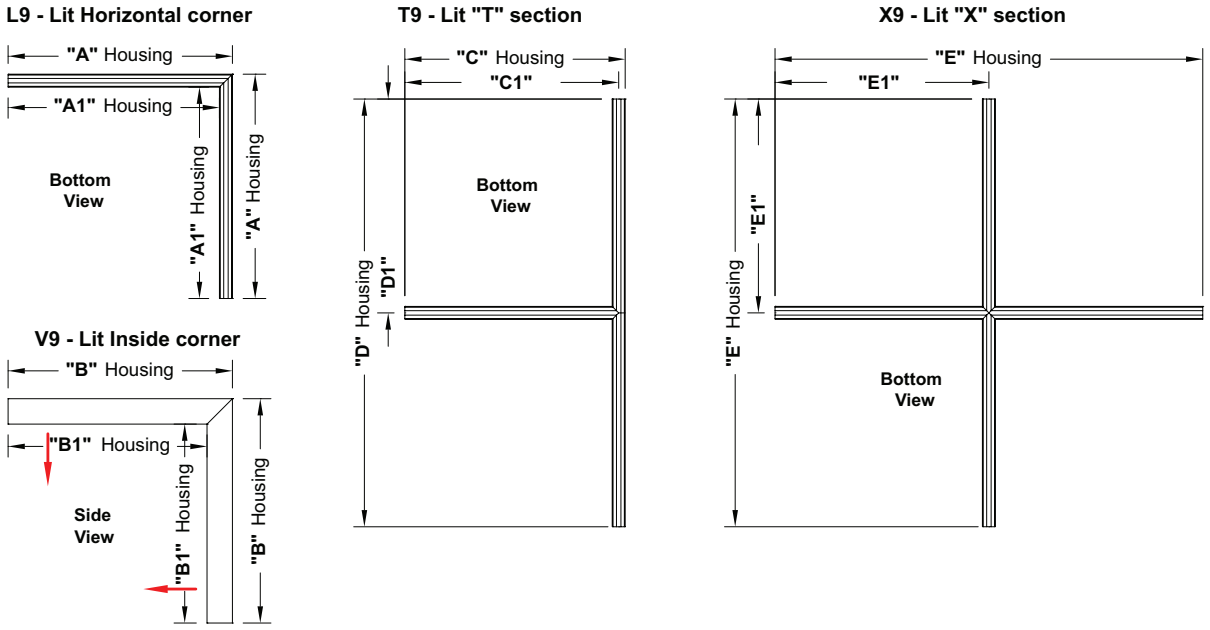
The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example, leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example, 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

Project Specific Recessed (W6R1/2) shapes/configurations:

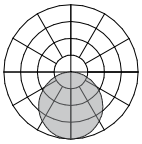
Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.



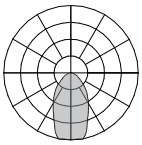
Recessed (W6R1/R2) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
"A" w/Flange (Outside)	2' - 1 3/4"	654						
"A1" Housing (Outside)	2' - 1 1/4"	642						
"B" w/Flange (Inside)	1' - 10 7/16"	570						
"B1" Housing (Inside)	1' - 10 15/16"	582						
"C" Housing (Inside)			2' - 3 1/16"	688				
"C1" Housing (Outside)			1' - 11 1/2"	597				
"D" w/Flange					2' - 1 3/4"	654		
"D1" Housing					2' - 1 1/4"	642		
"D2"					2' - 1/8"	612		
"E" Housing					4' - 3/16"	1224		
"E1"					2' - 1/8"	612		
"F" Housing							4' - 3/16"	1224
"F1"							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

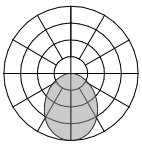
Photometry



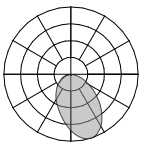
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81



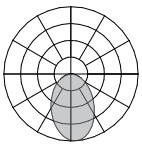
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2819	705	8.5	83



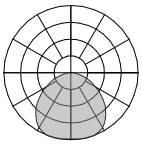
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3372	843	8.5	99



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81

W60 Recessed	
CCT Multiplier	
5500K	0.98
5000K	1.00
4000K	0.95
3500K	0.97
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

Received
By PCM3 at 12:54 pm, April 27, 2023

Date: _____ Customer: _____

Project: Compton College -VAPA

Type: ELT-4C Qty: _____

selux

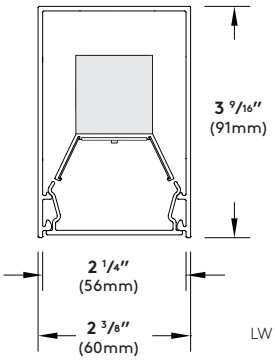
M60 LED H_2O Direct

for Wet Locations
(IP65 rated geartray and driver)

Order Code: W60 - ____ - ____ - ____ - ____ - ____ - ____ - ____ - DM10 - ____ - ____ - ____ - CN22xxxx

W60	Series	**W60** M60 LED H_2O	
____	Light Engine	**1C45** 80CRI-848lm 90CRI-712lm 11.1W per foot **1C40** 80CRI-794lm 90CRI-668lm 9.9W per foot **1C35** 80CRI-694lm 90CRI-584lm 8.7W per foot **1C30** 80CRI-621lm 90CRI-522lm 7.3W per foot **1C25** 80CRI-495lm 90CRI-416lm 6.1W per foot **1C20** 80CRI-411lm 90CRI-346m 4.9W per foot	* Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2.
____	CCT	**935** 3500K 90 CRI nominal **940** 4000K 90 CRI nominal **950** 5000K 90 CRI nominal **955** 5500K 90 CRI nominal **835**[1] **840**[1] **850**[1] **855**[1]	* See page 2 for details on CCT and CRI [1] Consult factory
____	Shielding	**LW** LED Optimized White Lens **MI** Clear Lens with Microprism **NB** LMO Symmetric with Satine Lens **A2** LMO Asymmetric 20° Wall Washer with Satine Lens **A5** LMO Asymmetric 5° Wall Grazer with Satine Lens **BW** LMO Batwing with Satine Lens	
____	Mounting	**C** Cable **S** Swivel Stem **RS** Rigid Stem **W** Wall Mount **F**[2] Surface Mount	[2]Over 8' supplied with 2 or more housings that are joined in the field.
____	Nominal Fixture Length	**02** 2 ft. **03** 3 ft. **04** 4 ft. **05** 5 ft. **06** 6 ft. **07** 7 ft. **08** 8 ft. **09** 9 ft. **10** 10 ft. **11** 11 ft. **12** 12 ft. **XX** Runs (over 12') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 13=13' nominal) *Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.*	
____	Finish	**WH** White **BL** Semi-Matte Black **SV** Silver **SP** Specify Premium Color	* *Custom colors are available, please consult factory*
____	Voltage	**1** 120V **2** 277V **U** 120V through 277V 50/60hz capable	
DM10	Driver	**DM10** 0-10V 10% (Linear)	*See page 7 for full details
____	Fixture Options	**SS**[3] Separate Switching	[3]See page 8 for details
____	Emergency Options	**EC**[4] Emergency Circuit Wiring **EMR** Remote Micro Inverter (consult factory)	[4]See page 8 for full details and restrictions
____	Configuration Options	**L9** Lit Horizontal 90° Corner **V9** Lit Inverted 90° Corner **T9** Lit "T" section **X9** Lit "X" section	* See page 9 for full details and restrictions
CN22xxxx		**CN22xxxx:** M60 LED with IP65 rated LED engine and IP rated driver	

selux



LW lens shown for reference

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 12') or Runs.

Geartray - Low copper 6063-T6 extruded aluminum profile. Geartray and connections encased in silicone for IP65 rating.

Shielding - Extruded, impact resistant acrylic lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - 1/16" Aircraft Cable, Ø5/8" Swivel or Rigid Steel Stem, Wall Bracket, Surface mounting (see pages 3 through 6 for details).
**Cable, Stem and Wall mountings may not be symmetrical for Runs and Configurations due to the use of modular housing lengths. If symmetrical suspensions are required please consult the factory.

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately 1/4" increments starting at the nominal 12' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with your requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaire.

W60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied W60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 9 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 10 for details.

CCT - Available in four CCTs. LEDs have a color shift due to the silicone encapsulation, and the delivered nominal CCTs are listed below.

CRI - 90 CRI standard, consult factory 80 CRI.

CRI / CCT	Nominal CCT
935	3500K
940	4000K
950	5000K
955	5500K

All Drivers - IP66 rated driver - constant current, Class 2 with a PFC>0.99. For more detailed information on the driver please see page 7.

Emergency - Emergency Circuit and Remote Micro Inverter. For more details on EC, see page 9.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for ambient temperatures of -40°C (-40°F) to 40°C (104°F).

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

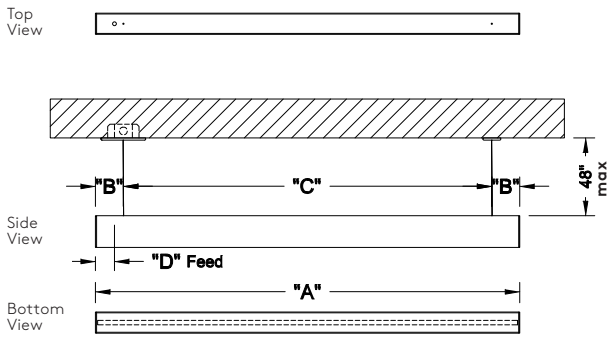
Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

Warranty:

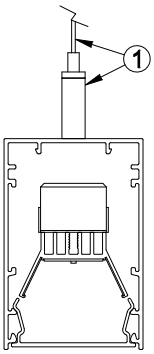
5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

Certifications and Compliance:

NRTL - For Wet location
(I.E. cULus; cCSAus)
ADA Compliant
ARRA Compliant
RoHS Compliant



Cable Mounting (C)

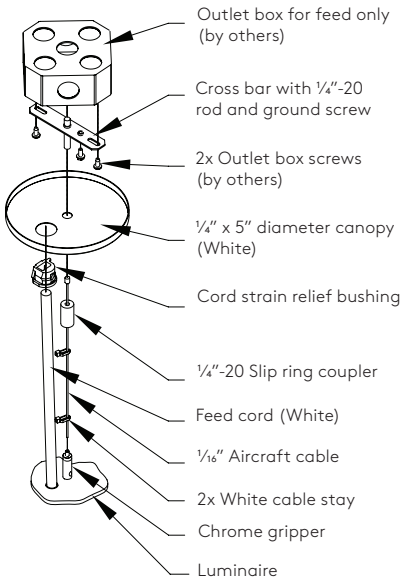


1. Ø 1/16" Aircraft Cable with chrome gripper for easy adjustment (48" maximum from ceiling to luminaire).

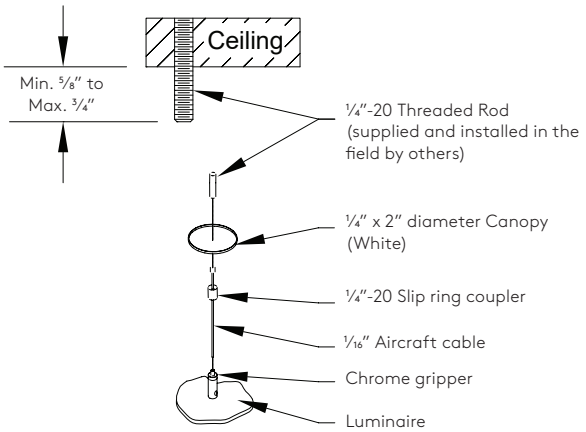
Cable Mounting (C) - Dimensions								
Nominal Length	**"A" Housing Length**		*** "B" End Suspensions**		**"C" Mid Suspension**		**"D" Feed Location**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2ft.)	2' - 1/4"	616	0' - 2 1/8"	54	1' - 8"	508	0' - 1 1/8"	29
03 (3ft.)	3' - 1/4"	921	0' - 3 1/8"	79	2' - 6"	762	0' - 2 1/8"	54
04 (4ft.)	4' - 1/4"	1226	0' - 3 1/8"	79	3' - 6"	1067	0' - 2 1/8"	54
05 (5ft.)	5' - 1/4"	1530	0' - 3 1/8"	79	4' - 6"	1372	0' - 2 1/8"	54
06 (6ft.)	6' - 1/4"	1835	0' - 3 1/8"	79	5' - 6"	1676	0' - 2 1/8"	54
07 (7ft.)	7' - 1/4"	2140	0' - 3 1/8"	79	6' - 6"	1981	0' - 2 1/8"	54
08 (8ft.)	8' - 1/4"	2445	0' - 3 1/8"	79	7' - 6"	2286	0' - 2 1/8"	54
09 (9ft.)	9' - 1/4"	2750	0' - 3 1/8"	79	8' - 6"	2591	0' - 2 1/8"	54
10 (10ft.)	10' - 1/4"	3054	0' - 3 1/8"	79	9' - 6"	2896	0' - 2 1/8"	54
11 (11ft.)	11' - 1/4"	3359	0' - 3 1/8"	79	10' - 6"	3200	0' - 2 1/8"	54
12 (12ft.)	12' - 1/4"	3664	0' - 3 1/8"	79	11' - 6"	3505	0' - 2 1/8"	54

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

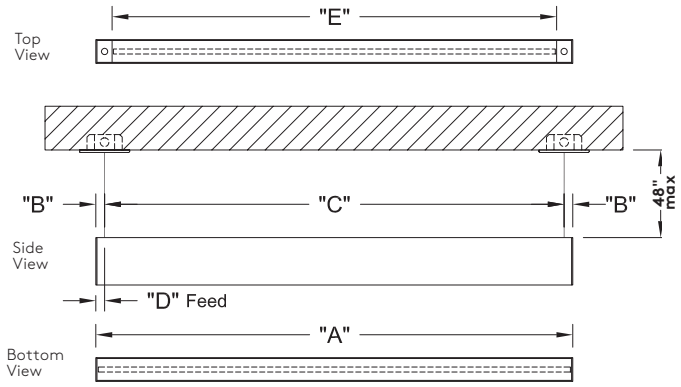
W60 Cable (C) Suspension Detail
(Feed location(s) only)



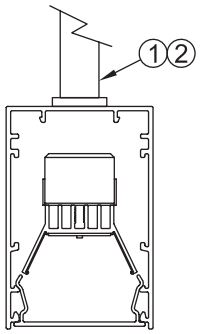
W60 Cable (C) Suspension Detail
(Non-Feed location(s) only)



Stem Mounting (S and RS)



Stem Mounting (S and RS)



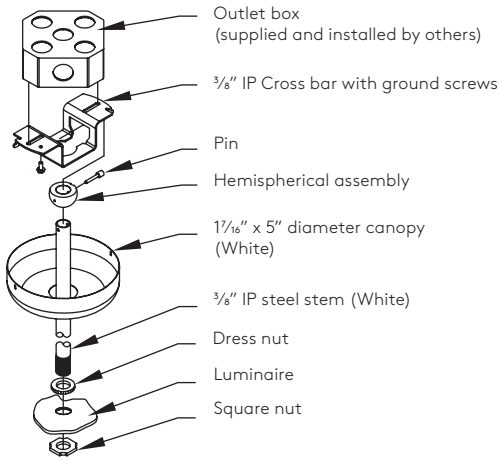
1. Ø ⅝" Swivel Stem provides 30° swivel and **can be cut in field** (48" maximum from ceiling to luminaire).
2. Ø ⅝" Rigid Stem is fixed and is **not able to be cut/adjusted in field** (48" maximum from ceiling to luminaire).

Swivel (S) & Rigid Stem (RS) Mountings - Dimensions

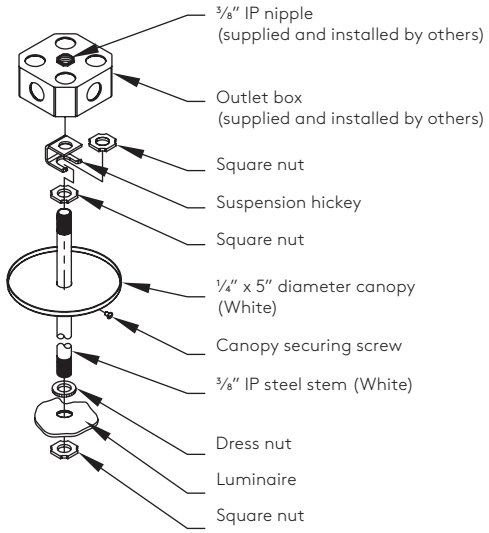
Nominal Length	"A" Housing Length		* "B" End Suspensions		"C" Mid Suspension		"D" Feed Location	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
02 (2ft.)	2' - ¼"	616	0' - 2 ⅛"	54	1' - 8"	508	0' - 2 ⅛"	54
03 (3ft.)	3' - ¼"	921	0' - 3 ⅛"	79	2' - 6"	762	0' - 3 ⅛"	79
04 (4ft.)	4' - ¼"	1226	0' - 3 ⅛"	79	3' - 6"	1067	0' - 3 ⅛"	79
05 (5ft.)	5' - ¼"	1530	0' - 3 ⅛"	79	4' - 6"	1372	0' - 3 ⅛"	79
06 (6ft.)	6' - ¼"	1835	0' - 3 ⅛"	79	5' - 6"	1676	0' - 3 ⅛"	79
07 (7ft.)	7' - ¼"	2140	0' - 3 ⅛"	79	6' - 6"	1981	0' - 3 ⅛"	79
08 (8ft.)	8' - ¼"	2445	0' - 3 ⅛"	79	7' - 6"	2286	0' - 3 ⅛"	79
09 (9ft.)	9' - ¼"	2750	0' - 3 ⅛"	79	8' - 6"	2591	0' - 3 ⅛"	79
10 (10ft.)	10' - ¼"	3054	0' - 3 ⅛"	79	9' - 6"	2896	0' - 3 ⅛"	79
11 (11ft.)	11' - ¼"	3359	0' - 3 ⅛"	79	10' - 6"	3200	0' - 3 ⅛"	79
12 (12ft.)	12' - ¼"	3664	0' - 3 ⅛"	79	11' - 6"	3505	0' - 3 ⅛"	79

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

W60 Swivel Stem (S) Suspension Detail
(feed wires through stem supplied by Selux)

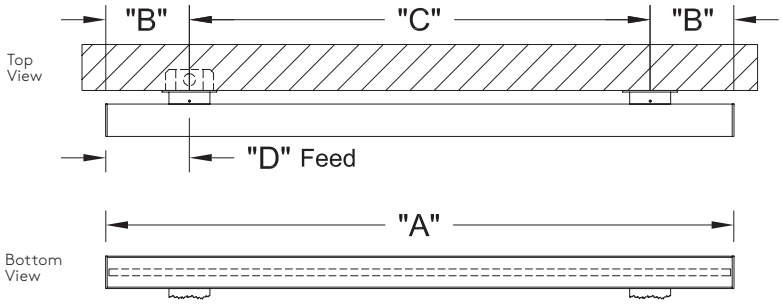


W60 Rigid Stem (RS) Suspension Detail
(feed wires through stem supplied by Selux)



Wall Mounting (W)

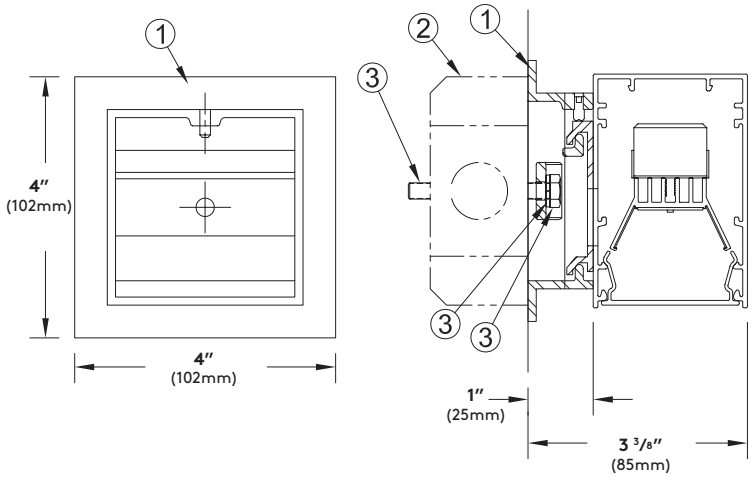
For mounting in direct lighting position only for patterns and configurations that include a wall mount, please see page 12 for details.



Wall (W) Mount - Dimensions								
Nominal Length	**"A" Housing Length**		*** "B" End Suspensions**		**"C" Mid Suspension**		**"D" Feed Location**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2 ft.)	2' - ¼"	616	3 ⅛"	79	1' - 0"	458	0 - 3 ⅛"	79
03 (3 ft.)	3' - ¼"	921	6 ⅛"	156	2' - 6"	610	0 - 6 ⅛"	156
04 (4 ft.)	4' - ¼"	1226	6 ⅛"	156	3' - 0"	914	0 - 6 ⅛"	156
05 (5 ft.)	5' - ¼"	1530	6 ⅛"	156	4' - 0"	1219	0 - 6 ⅛"	156
06 (6 ft.)	6' - ¼"	1835	6 ⅛"	156	5' - 0"	1524	0 - 6 ⅛"	156
07 (7 ft.)	7' - ¼"	2140	6 ⅛"	156	6' - 0"	1829	0 - 6 ⅛"	156
08 (8 ft.)	8' - ¼"	2445	6 ⅛"	156	7' - 0"	2134	0 - 6 ⅛"	156
09 (9 ft.)	9' - ¼"	2750	6 ⅛"	156	8' - 0"	2438	0 - 6 ⅛"	156
10 (10 ft.)	10' - ¼"	3054	6 ⅛"	156	9' - 0"	2743	0 - 6 ⅛"	156
11 (11 ft.)	11' - ¼"	3359	6 ⅛"	156	10' - 0"	3048	0 - 6 ⅛"	156
12 (12 ft.)	12' - ¼"	3664	6 ⅛"	156	11' - 0"	3353	0 - 6 ⅛"	156

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

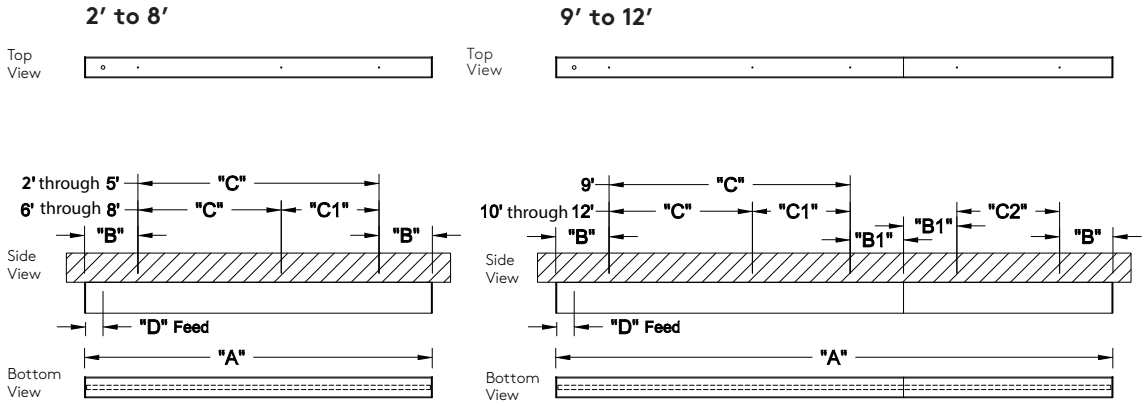
Wall Mount (W)
(Covers a 4x4 or 2x4 J-box)



1. Aluminum wall bracket (by Selux).
2. 4"x4" or 2"x4" J-box at feed location (supplied and installed by others).
3. ¼"-20 Threaded rod, ¼"-20 lock washer and ¼"-20 nut required to anchor the wall bracket. Mounting hardware supplied and installed to code by others.

Surface Mounting (F)

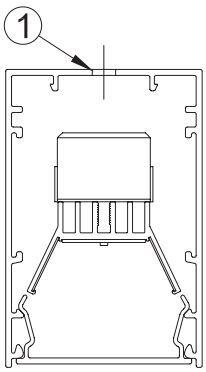
Can be mounted to ceiling or wall surface



Surface Mount (F) - Dimensions														
Nominal Length	"A" Housing Length		* "B" End Suspensions		* "B1" End Suspensions		"C" Mid Suspension		"C1" Mid Suspension		"C2" Mid Suspension		"D" Feed Location	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
02 (2 ft.)	2' - ¼"	616	0' - 1 ⅝"	41	N/A		1' - 9"	533	N/A		N/A		0' - 4 ⅛"	105
03 (3 ft.)	3' - ¼"	921	0' - 6 ⅛"	156	N/A		2' - 0"	610	N/A		N/A		0' - 2 ⅛"	54
04 (4 ft.)	4' - ¼"	1226	0' - 6 ⅛"	156	N/A		3' - 0"	914	N/A		N/A		0' - 2 ⅛"	54
05 (5 ft.)	5' - ¼"	1530	0' - 6 ⅛"	156	N/A		4' - 0"	1219	N/A		N/A		0' - 2 ⅛"	54
06 (6 ft.)	6' - ¼"	1835	0' - 6 ⅛"	156	N/A		3' - 0"	914	2' - 0"	610	N/A		0' - 2 ⅛"	54
07 (7 ft.)	7' - ¼"	2140	0' - 6 ⅛"	156	N/A		3' - 0"	914	3' - 0"	914	N/A		0' - 2 ⅛"	54
08 (8 ft.)	8' - ¼"	2445	0' - 6 ⅛"	156	N/A		3' - 0"	914	4' - 0"	1219	N/A		0' - 2 ⅛"	54
09 (9 ft.)	9' - ¼"	2750	0' - 6 ⅛"	156	0' - 6"	152	4' - 0"	1219	N/A		3' - 0"	914	0' - 2 ⅛"	54
10 (10 ft.)	10' - ¼"	3054	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	2' - 0"	610	3' - 0"	914	0' - 2 ⅛"	54
11 (11 ft.)	11' - ¼"	3359	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	3' - 0"	914	3' - 0"	914	0' - 2 ⅛"	54
12 (12 ft.)	12' - ¼"	3664	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	4' - 0"	1219	3' - 0"	914	0' - 2 ⅛"	54

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Surface Mount (F)



***Please note: Fixture does not cover a 4x4 J-box**

1. Ø 5/16" Mounting hole drilled at the factory (mounting hardware to code by others).

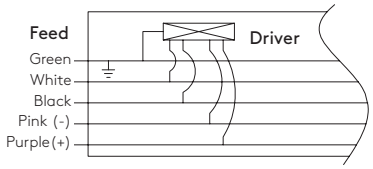
0-10V linear dimming (DM10)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 10%.

* For control recommendations, please contact driver manufacturer.

Light Engine	Driver Quantity										
	2ft	**3ft**	**4ft**	**5ft**	**6ft**	**7ft**	**8ft**	**9ft**	**10ft**	**11ft**	**12ft**
1C20	1							2	2		1
1C25	1					1		2	2		1
1C30	1				1			2	2		2
1C35	1			1	2	1		2	2		2
1C40	1			1	2		2			3	
1C45	1			2	1	2		3	2	3	

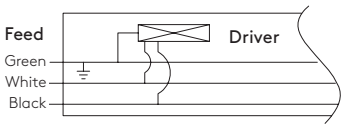
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED ECOdrive (DIL)
DALI-2 logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

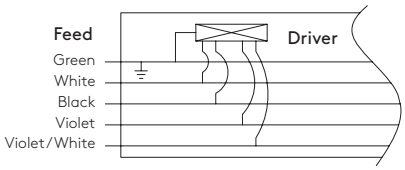


Standard Wiring supplied for all drivers	Green = Ground White = Neutral (120V/277V/347V) or L2 (240V) Black = Hot/L1 (120V-347V)
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED, D01, DL01	Pink = (-) DALI-2 or 0-10V Dimming Control Purple = (+) DALI-2 or 0-10V Dimming Control
DC2	No additional wires
DE1	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)



Lutron EcoSystem (DE1)



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage			
Driver	**Light Engine**	**Nominal W/ft**	
		120V	**277V**
DM10	1C20	4.9	5.3
	1C25	6.1	6.5
	1C30	7.3	7.7
	1C35	8.7	8.9
	1C40	9.9	10.1
	1C45	11.1	11.3

Emergency Wiring (EC) - EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

* For 2′ to 6′ nominal luminaires, the entire fixture is wired for operation on emergency circuit.

* For 7′ and up nominal luminaires, the first 4′ nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

* If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

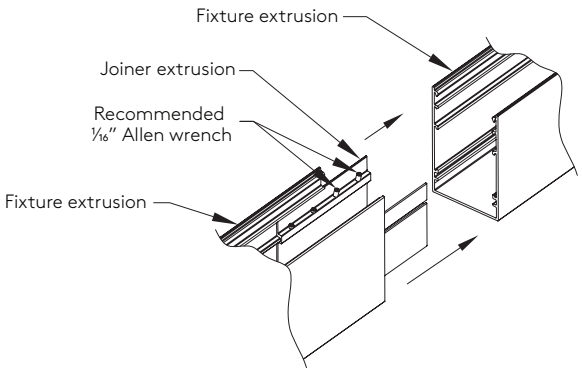
Separate Switching (SS) - Luminaires available with separately switched 4′ (nominal) sections starting at 7′ and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

* All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

* To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

* If the project requires different separate switching than outlined above please consult the factory.

Joiner System - standard for Runs and Configurations



Standard Direct shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

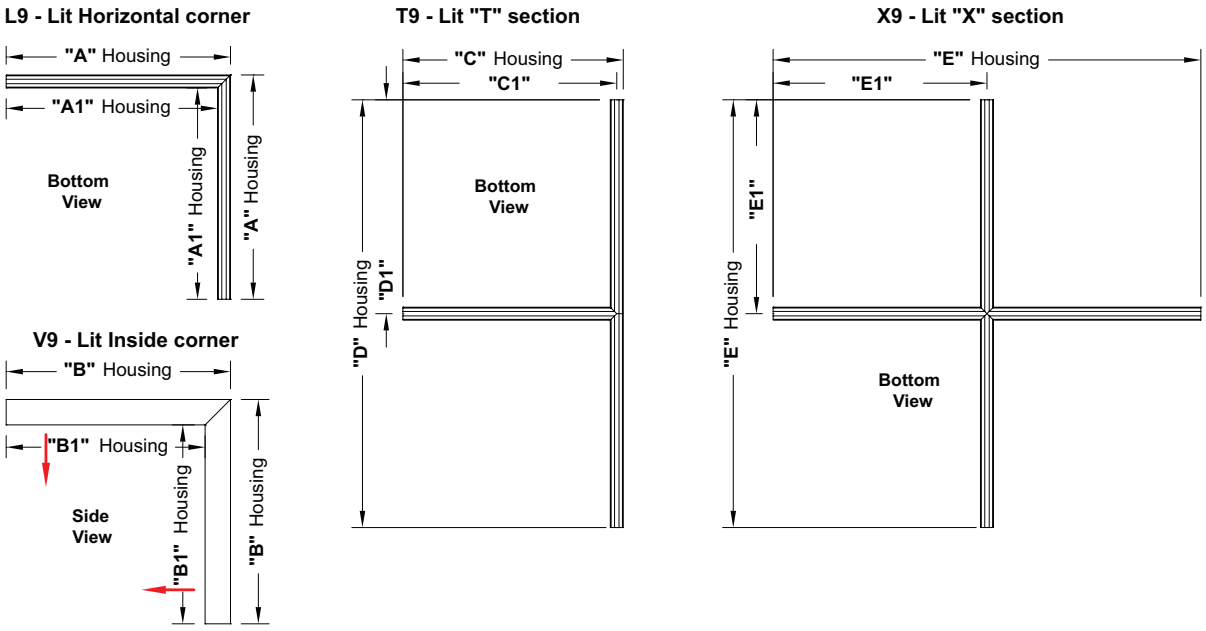
*For sensors in configurations, please consult factory.

For patterns and configurations that are to include a wall mounted option, please consult the factory to identify location, on which side of housing and spacing of brackets required.

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

Project Specific Direct shapes/configurations:

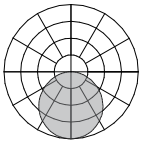
Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.



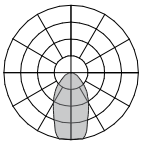
Direct Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
"A" Housing (Outside)	2' - 1¼"	642						
"A1" Housing (Inside)	1' - 10¹⁵⁄₁₆"	582						
"B" Housing (Outside)			2' - 3¹⁄₁₆"	688				
"B1" Housing (Inside)			1' - 11½"	597				
"C" Housing					2' - 1¼"	642		
"C1"					2' - ⅛"	612		
"D" Housing					4' - ³⁄₁₆"	1224		
"D1"					2' - ⅛"	612		
"E" Housing							4' - ³⁄₁₆"	1224
"E1"							2' - ⅛"	612

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

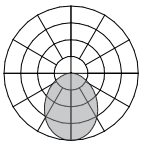
Photometry



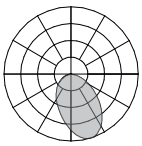
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81



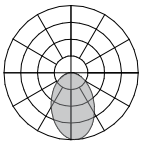
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2819	705	8.5	83



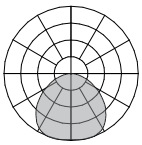
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3372	843	8.5	99



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81

W60 Direct	
CCT Multiplier	
5500K	0.98
5000K	1.00
4000K	0.95
3500K	0.97
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

Maximum Candela = 573.374156096399 at 0 H 2.5 V

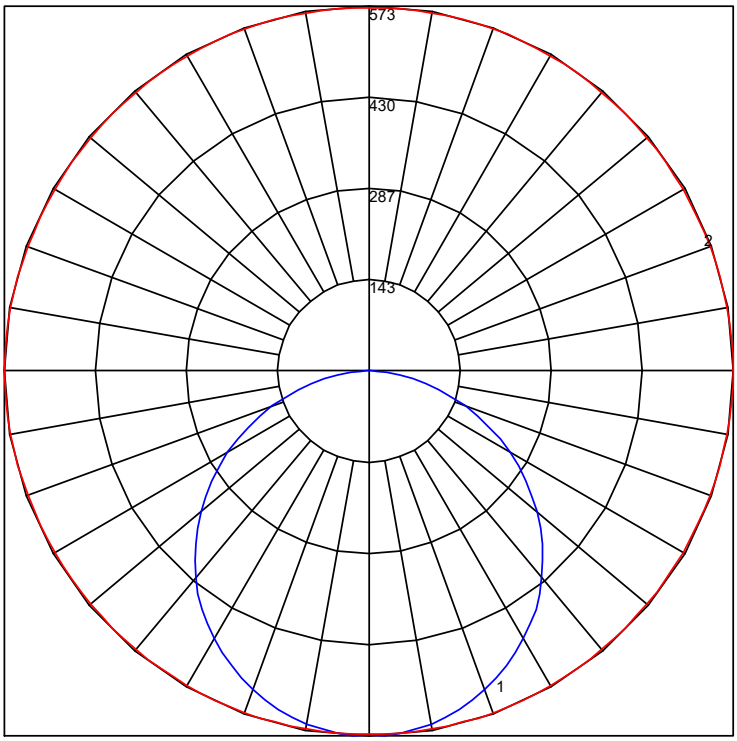
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

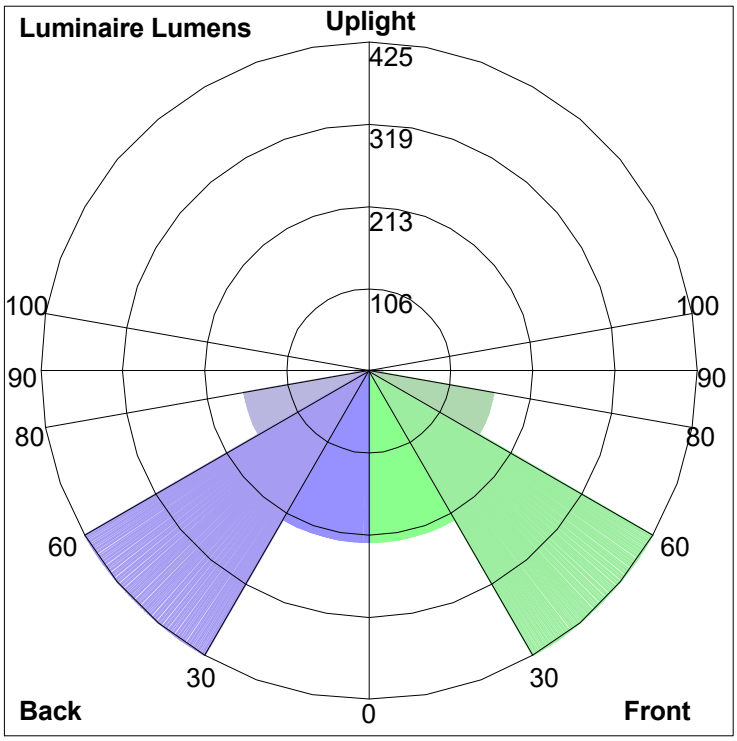
Maximum Candela = 573.374156096399 at 0 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	221.8	N.A.	13.4
FM (30-60)	425.3	N.A.	25.6
FH (60-80)	164.2	N.A.	9.9
FVH (80-90)	17.9	N.A.	1.1
BL (0-30)	221.8	N.A.	13.4
BM (30-60)	425.3	N.A.	25.6
BH (60-80)	164.2	N.A.	9.9
BVH (80-90)	17.9	N.A.	1.1
UL (90-100)	0.4	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1658.8	N.A.	100.0
BUG Rating	B1-U1-G1		



Photometric Report (Type C)

Filename: L60W-1C20-35-A5-X-04-XX-UNV.ies
[TEST] prorated from 12650529.11
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 2/12/2019 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-A5-X-04-XX-UNV

Maximum Candela = 893.199995160103 at 0 H 4 V

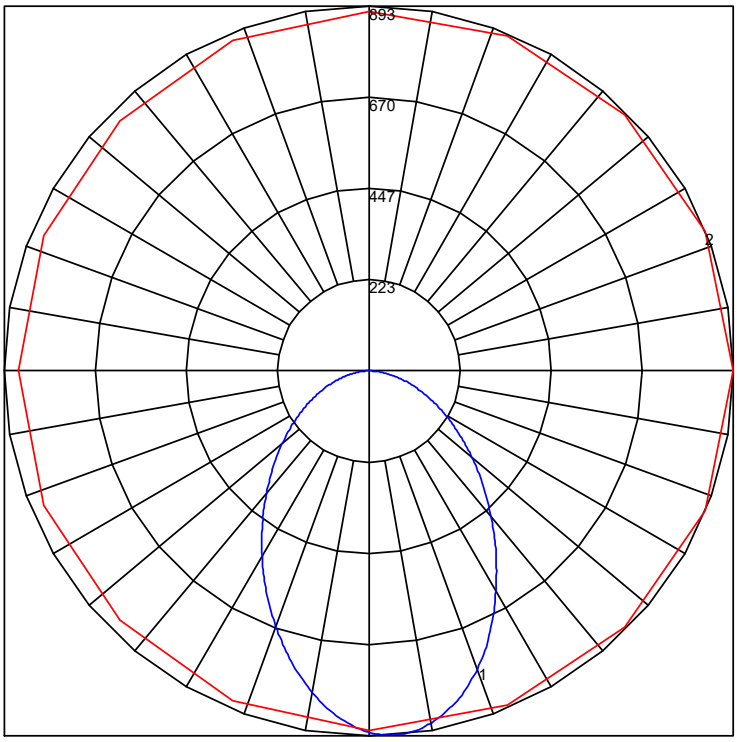
Classification:

Road Classification: Type I, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 94
Maximum UGR: 25
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 4 Vertical



ELT-04A

Photometric Report (Type C)

Filename: L60W-1C20-35-A5-X-04-XX-UNV.ies
[TEST] prorated from 12650529.11
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 2/12/2019 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-A5-X-04-XX-UNV

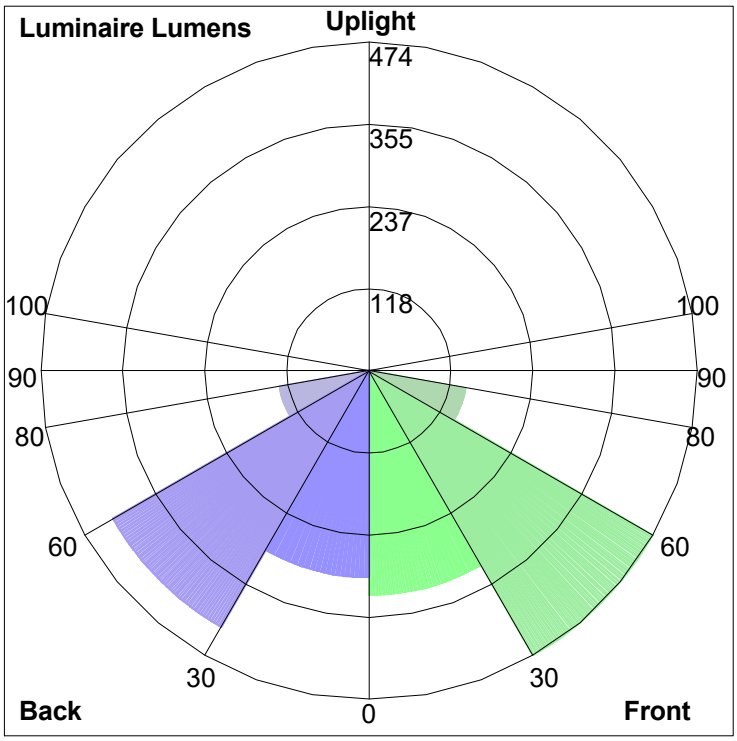
Maximum Candela = 893.199995160103 at 0 H 4 V

Classification:

Road Classification: Type I, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 94
Maximum UGR: 25
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	323.4	N.A.	17.7
FM (30-60)	473.9	N.A.	26.0
FH (60-80)	142.0	N.A.	7.8
FVH (80-90)	14.1	N.A.	0.8
BL (0-30)	298.2	N.A.	16.4
BM (30-60)	427.1	N.A.	23.4
BH (60-80)	131.1	N.A.	7.2
BVH (80-90)	13.6	N.A.	0.7
UL (90-100)	< 0.05	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1823.4	N.A.	100.0
BUG Rating	B1-U1-G1		



ELT-04B

Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

Maximum Candela = 573.374156096399 at 0 H 2.5 V

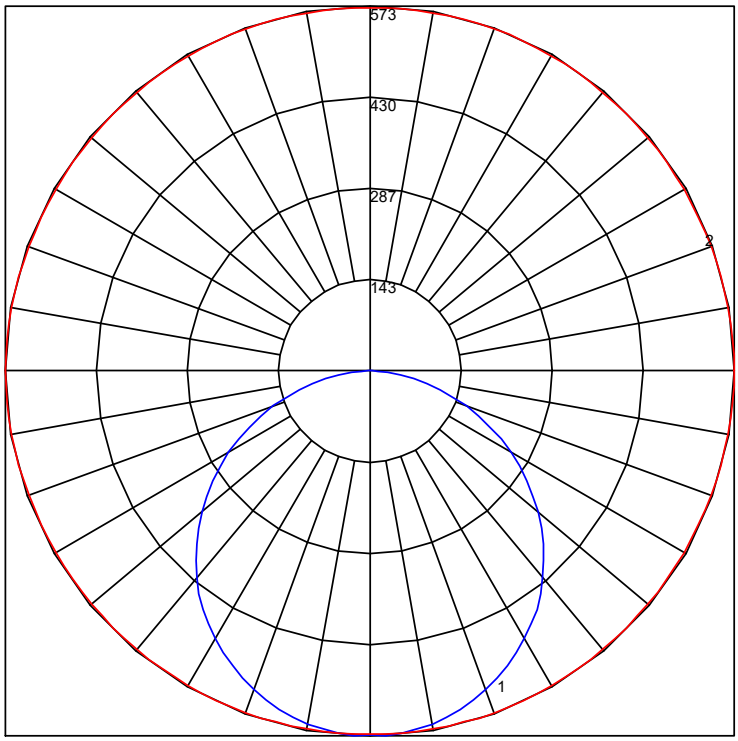
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



ELT-04B

Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

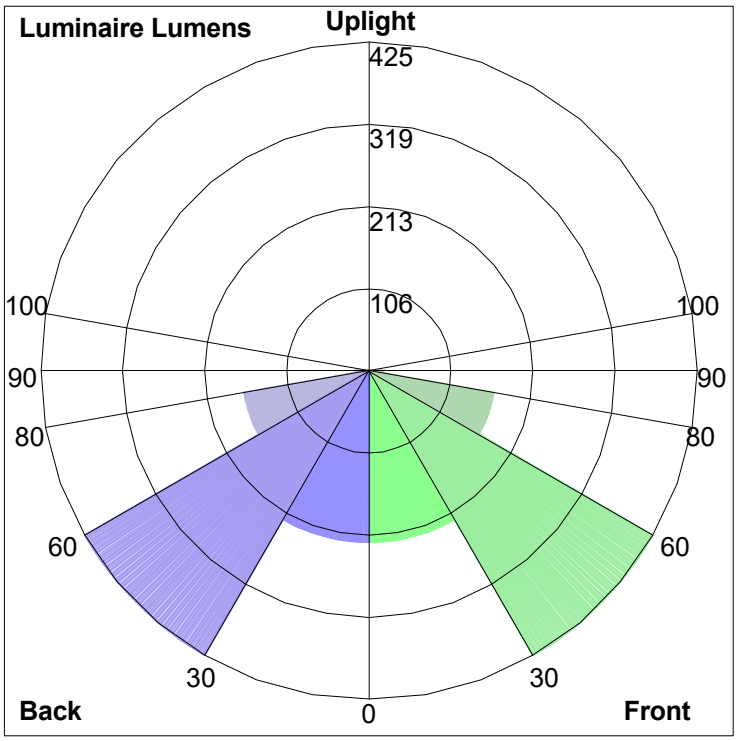
Maximum Candela = 573.374156096399 at 0 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	221.8	N.A.	13.4
FM (30-60)	425.3	N.A.	25.6
FH (60-80)	164.2	N.A.	9.9
FVH (80-90)	17.9	N.A.	1.1
BL (0-30)	221.8	N.A.	13.4
BM (30-60)	425.3	N.A.	25.6
BH (60-80)	164.2	N.A.	9.9
BVH (80-90)	17.9	N.A.	1.1
UL (90-100)	0.4	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1658.8	N.A.	100.0
BUG Rating	B1-U1-G1		



ELT-04C

Photometric Report (Type C)

Filename: L60W-1C20-35-MI-X-04-XX-UNV.ies
[TEST] prorated from 11685012.05B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/5/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-MI-X-04-XX-UNV

Maximum Candela = 1190.1696543383 at 0 H 10 V

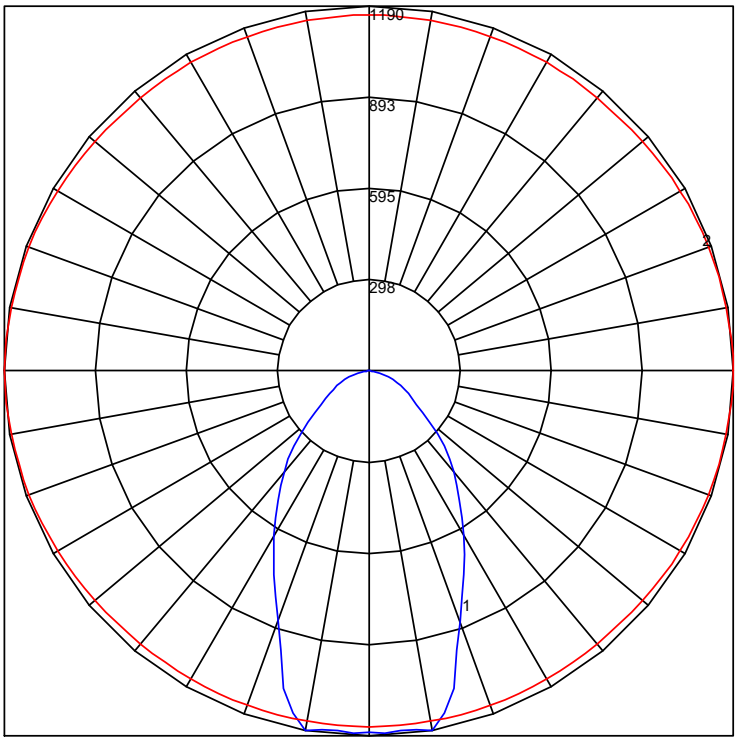
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 100
Maximum UGR: 21.1
Indoor Classification: Direct
BUG Rating : B1-U0-G0

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 10 Vertical



ELT-04C

Photometric Report (Type C)

Filename: L60W-1C20-35-MI-X-04-XX-UNV.ies
[TEST] prorated from 11685012.05B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/5/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-MI-X-04-XX-UNV

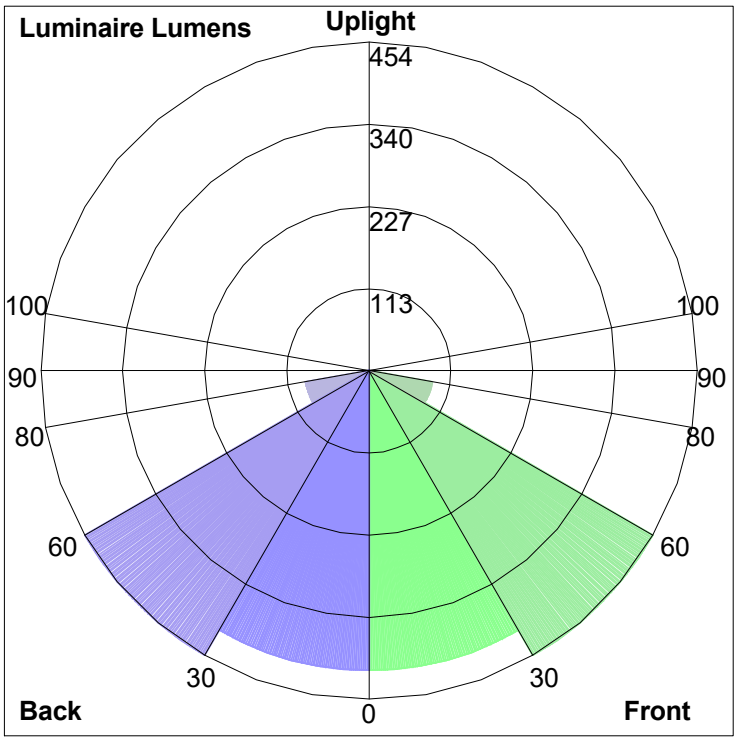
Maximum Candela = 1190.1696543383 at 0 H 10 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 100
Maximum UGR: 21.1
Indoor Classification: Direct
BUG Rating : B1-U0-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	413.5	N.A.	21.5
FM (30-60)	453.5	N.A.	23.6
FH (60-80)	88.7	N.A.	4.6
FVH (80-90)	6.1	N.A.	0.3
BL (0-30)	413.5	N.A.	21.5
BM (30-60)	453.5	N.A.	23.6
BH (60-80)	88.7	N.A.	4.6
BVH (80-90)	6.1	N.A.	0.3
UL (90-100)	0.0	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1923.6	N.A.	100.0
BUG Rating	B1-U0-G0		



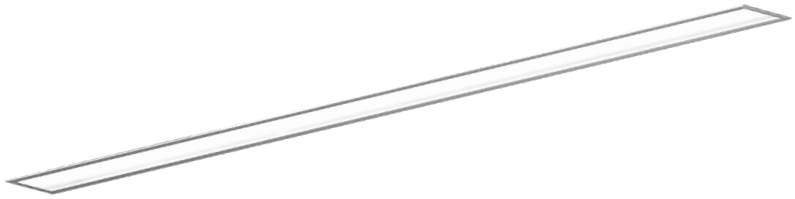
Date: _____ Customer: _____

Project: Compton College -VAPA

Type: ELT-5 / ELT-5A / ELT-5B Qty: _____

selux

M60 LED H_2O Recessed
for Wet Locations
(IP65 rated geartray and driver)



Order Code: _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - CN22xxxx

_____	**Series**	**W60** M60 LED H_2O Multi-Mount Form for Wet Location	**W6R1** M60 LED H_2O Continuous Flange (Flanged Endcaps) for Wet Location
		W6R2 M60 LED H_2O Continuous Flange (Flangeless Endcaps) for Wet Location	
_____	**Light Engine**	**1C45** 80CRI-848lm 90CRI-712lm 11.1W per foot	**1C40** 80CRI-794lm 90CRI-668lm 9.9W per foot
		1C35 80CRI-694lm 90CRI-584lm 8.7W per foot	**1C30** 80CRI-621lm 90CRI-522lm 7.3W per foot
		1C25 80CRI-495lm 90CRI-416lm 6.1W per foot	**1C20** 80CRI-411lm 90CRI-346m 4.9W per foot
			*Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2.
_____	**CCT**	**935** 3500K 90 CRI nominal	**940** 4000K 90 CRI nominal
		950 5000K 90 CRI nominal	**955** 5500K 90 CRI nominal
		835[1] **840**[1] **850**[1] **855**[1]	* See page 2 for details on CCT and CRI [1] Consult factory
_____	**Shielding**	**LW** LED Optimized White Lens	**MI** Clear Lens with Microprism
		NB LMO Symmetric with Satine Lens	**A2** LMO Asymmetric 20° Wall Washer with Satine Lens
		A5 LMO Asymmetric 5° Wall Grazer with Satine Lens	**BW** LMO Batwing with Satine Lens
_____	**Mounting W60**	**SF1** Spackle Flange (½" Drywall)	**SF2** Spackle Flange (⅝" Drywall)
		SF3 Spackle Flange (After Drywall)	**SG** Slot Grid (9⁄16") (Wire Suspension or ¼"-20 stud)
		DC Decoustic Ceiling (up to 2" thick)	
	or		
_____	**Mounting W6R1 or W6R2**	**TB**[2] T-Bar Length with suspension clips	**TBS**[2] T-Bar Length with 1" ¼"-20 Stud
		RC[2] Rotating Crossbar (Ceilings ¼" to 2" thick)	**TS** 1" ¼"-20 Stud
			[2] L6R1 only
_____	**Nominal Fixture Length**	**02**[3] 2 ft. **03** 3 ft. **04**[3] 4 ft. **05**[3] 5 ft. **06**[3] 6 ft. **07** 7 ft. **08**[3] 8 ft.	**XX** Runs (over 8') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 09=09' nominal)
			[3] Length intended to fit centered between the grid for SG, TB, TBS mountings
		Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.	
_____	**Finish**	**WH** White	**BL** Semi-Matte Black
		SV Silver	**SP** Specify Premium Color
			Custom colors are available, please consult factory
_____	**Voltage**	**1** 120V	**2** 277V
		U 120V through 277V 50/60hz capable	
_____	**Driver**	**DM10** 0-10V 10% (Linear)	
			* See page 7 for full details
_____	**Fixture Options**	**SS**[4] Separate Switching	**CCEA** CCEA approved
			[4] See page 10 for details
_____	**Emergency Options**	**EC**[5] Emergency Circuit Wiring	**EMR** Remote Micro Inverter (consult factory)
			[5] See page 10 for full details and restrictions
_____	**Configuration Options**	**L9** Lit Horizontal 90° Corner	**V9** Lit Inverted 90° Corner
		T9 Lit "T" section	**X9** Lit "X" section
			*See pages 12 for full details and restrictions
CN22xxxx		**CN22xxxx:** M60 LED with IP65 rated LED engine and IP rated driver	

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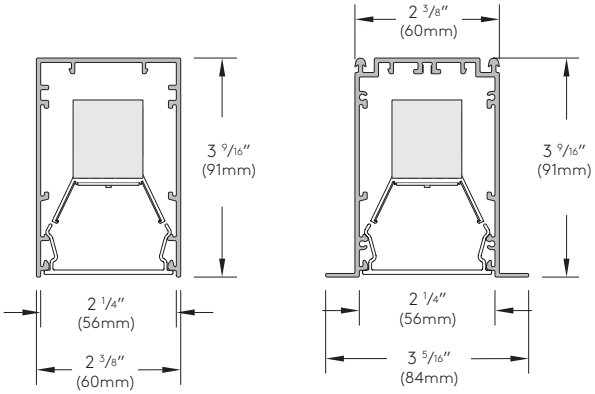

LW lens shown for reference

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 8') or Runs.

Flange (W6R1 or W6R2 Series) - 9/16" (14mm) wide flange runs full lengths of both sides and is part of the main extruded body. Specify continuous flange (W6R1) or flush (W6R2) end cap. W6R2 does not work in T-Bar ceiling.

Geartray - Low copper 6063-T6 extruded aluminum profile. Geartray and connections encased in silicone for IP65 rating.

Shielding - Extruded, impact resistant acrylic snap in lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - Spackle-in (drywall), Slot grid, Decoustic, T-bar grid, Rotating Crossbar and Threaded Stud Mountings (see pages 3 through 6 for details).

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately 1/4" increments starting at the nominal 8' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with you requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaires.

W60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied W60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 8 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 11 for details.

CCT - Available in four CCTs. LEDs have a color shift due to the silicone encapsulation, and the delivered nominal CCTs are listed below.

CRI - 90 CRI standard, consult factory 80 CRI.

CRI / CCT	Nominal CCT
935	3500K
940	4000K
950	5000K
955	5500K

All Drivers - IP66 rated driver - constant current, Class 2 with a PFC>0.99. For more detailed information on the driver please see page 7.

Emergency - Emergency Circuit and Remote Micro Inverter. For more details on EC, see page 8.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for ambient temperatures of -40°C (-40°F) to 40°C (104°F).

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

Warranty:

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

Certifications and Compliance:

NRTL - For Wet location
(I.E. cULus; cCSAus)
ARRA Compliant
RoHS Compliant
IC Rated (EM option is non-IC Rated)

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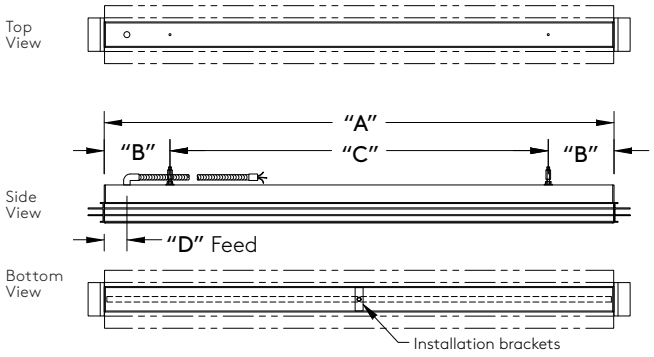
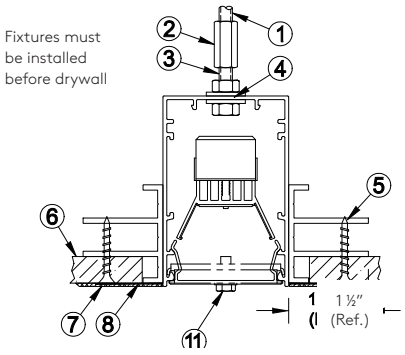
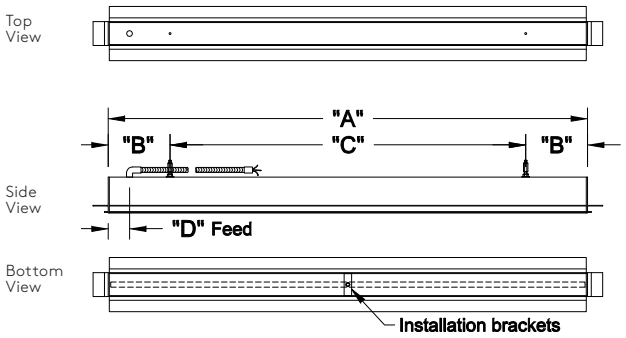
½" Spackle Flange Mounting (SF1)



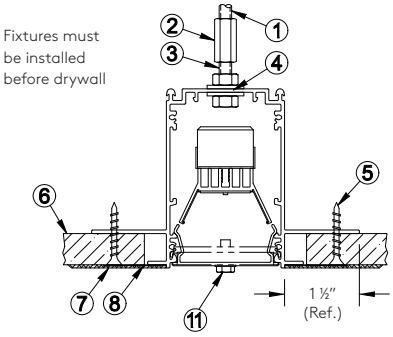
½" Spackle Flange Mounting (SF1)



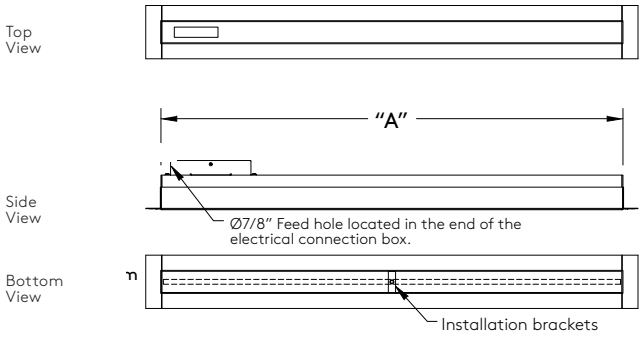
⅝" Spackle Flange Mounting (SF2)



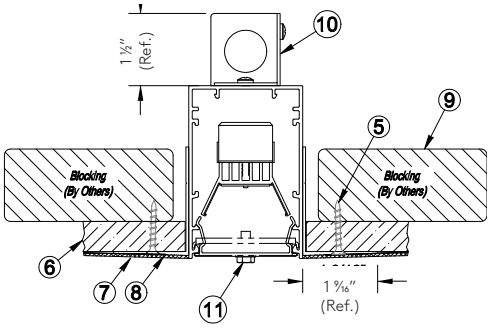
⅝" Spackle Flange Mounting (SF2)



After Drywall Flange Mounting (SF3)



After Drywall Flange Mounting (SF3)

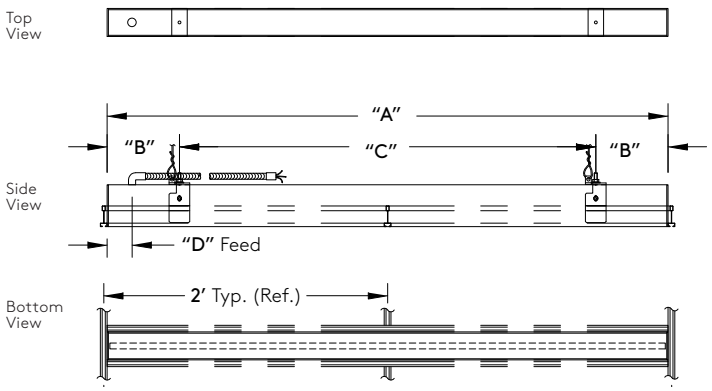


Spackle Flange Mounting (SF1, SF2 and SF3) - Dimensions								
Nominal Length	**"A" O.A.L. without Flange**		**"B" End Suspensions**		*** "C" Mid Suspension**		**"D" Feed Location**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2 ft.)	2' - ¼''	616	0' -1 ⅝''	41	1' - 9''	533	0' - 4 ⅛''	105
03 (3 ft.)	3' - ¼''	921	0' -6 ⅛''	156	2' - 0''	609	0' - 2 ⅛''	54
04 (4 ft.)	4' - ¼''	1226	0' -6 ⅛''	156	3' - 0''	914	0' - 2 ⅛''	54
05 (5 ft.)	5' - ¼''	1530	0' -6 ⅛''	156	4' - 0''	1219	0' - 2 ⅛''	54
06 (6 ft.)	6' - ¼''	1835	0' -6 ⅛''	156	5' - 0''	1524	0' - 2 ⅛''	54
07 (7 ft.)	7' - ¼''	2140	0' -6 ⅛''	156	6' - 0''	1829	0' - 2 ⅛''	54
08 (8 ft.)	8' - ¼''	2445	0' -6 ⅛''	156	7' - 0''	2134	0' - 2 ⅛''	54

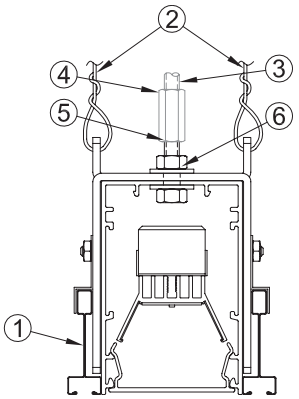
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to struture (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. Drywall/Drywall screw (Ref.)
6. Drywall/Drywall (Ref.)
7. ⅛" Plaster skimcoat (Ref.)
8. Drywall/Drywall tape (Ref.)
9. Blocking to secure fixture (by others)
10. Electrical connection box, removable side cover for electrical connection pre-installation, once installed the wiring is accessible from below the ceiling through the luminaire.
11. Luminaires ship with the brackets pre-installed.
    - The brackets cannot be removed until the fixture is completely installed and secured through the spackle flange.
    - Once the brackets are removed, the lens can be installed.

Slot Grid Mounting (SG)



9/16" Slot Grid Mounting (SG)
(Wire Suspension or 1/4"-20 Stud)

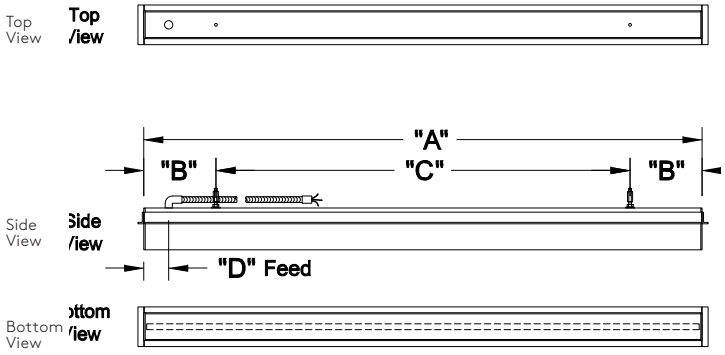


1. 9/16" Slot grid (shown as Ref.)
2. Support wire to structure (supplied and installed by others).
3. 1/4"-20 Threaded rod to structure (supplied and installed by others).
4. 1/4"-20 Coupler hardware (supplied and installed by others).
5. 1" 1/4"-20 Stud (by Selux).
6. Ø5/16" (Ø7mm) mounting hole.

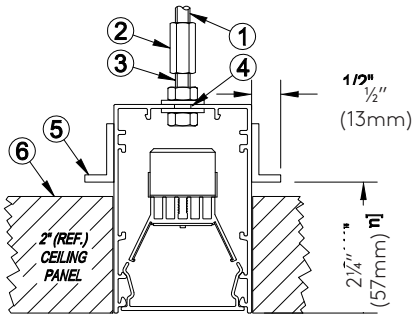
Slot Grid Mounting (SG) - Dimensions									
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" Mid Suspension		"D" Feed Location		"E" Grid Spacing
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	
02 (2 ft.)	1' - 11 5/16"	592	0' -1 5/8"	41	1' - 5 3/16"	437	0' - 1 1/8"	29	2' Center to Center
04 (4 ft.)	3' - 11 5/16"	1202	0' - 6 1/8"	156	2' - 11 3/16"	894	0' - 2 1/8"	54	4' Center to Center
05 (5 ft.)	4' - 11 5/16"	1507	0' - 6 1/8"	156	3' - 11 3/16"	1199	0' - 2 1/8"	54	5' Center to Center
06 (6 ft.)	5' - 11 5/16"	1811	0' - 6 1/8"	156	5' - 11 3/16"	1504	0' - 2 1/8"	54	6' Center to Center
08 (8 ft.)	7' - 11 5/16"	2421	0' - 6 1/8"	156	6' - 11 3/16"	2113	0' - 2 1/8"	54	8' Center to Center

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Decoustic Mounting (DC)



Decoustic Mounting (DC)
(Panels up to 2" thick)



Decoustic Mounting (DC) - Dimensions								
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" Mid Suspension		"D" Feed Location	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
02 (2 ft.)	2' - 1/4"	616	1 5/8"	41	1' - 9"	533	0' - 4 1/8"	105
03 (3 ft.)	3' - 1/4"	921	6 1/8"	156	2' - 0"	609	0' - 2 1/8"	54
04 (4 ft.)	4' - 1/4"	1226	6 1/8"	156	3' - 0"	914	0' - 2 1/8"	54
05 (5 ft.)	5' - 1/4"	1530	6 1/8"	156	4' - 0"	1219	0' - 2 1/8"	54
06 (6 ft.)	6' - 1/4"	1835	6 1/8"	156	5' - 0"	1524	0' - 2 1/8"	54
07 (7 ft.)	7' - 1/4"	2140	6 1/8"	156	6' - 0"	1829	0' - 2 1/8"	54
08 (8 ft.)	8' - 1/4"	2445	6 1/8"	156	7' - 0"	2134	0' - 2 1/8"	54

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

1. 1/4"-20 Threaded rod to structure (supplied and installed by others).
2. 1/4"-20 Coupler hardware (supplied and installed by others).
3. 1" 1/4"-20 Stud (by Selux).
4. Ø5/16" (Ø7mm) mounting hole.
5. 1/2" wide aluminum angle runs the entire length of fixture to block view into plenum area from below fixture.
6. Suitable for Decoustic® ceiling panel installations with panels up to 2" thick (supplied and installed by others). Other ceiling systems possible, please consult factory. Decoustic® is a registered trademark of Decoustics Ltd. Corporation.

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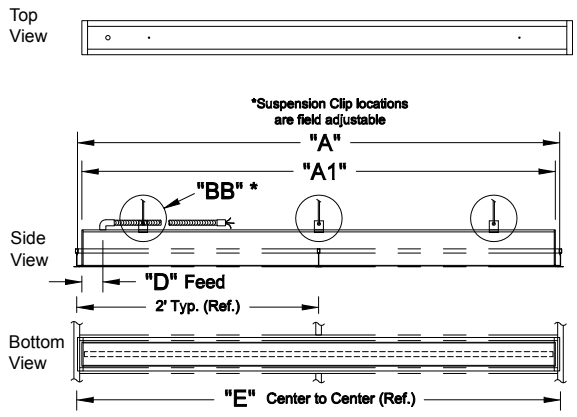
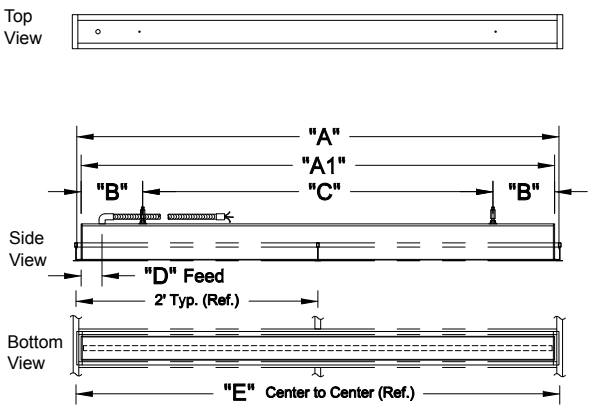
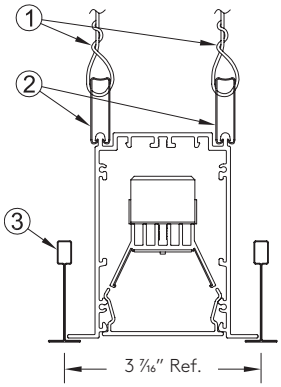
T-Bar Mounting (TB)



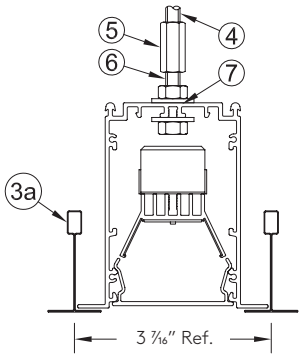
T-Bar with Stud Mounting (TBS)



T-Bar with Suspension Clips (TB)
(9⁄16" or 15⁄16" grid)



T-Bar with ¼"-20 Stud (TBS)
(9⁄16" or 15⁄16" grid)



1. Support wire to structure (supplied and installed by others).
2. Spring steel suspension clips located approximately every 4 ft. (supplied by Selux).
3. 9⁄16" T-bar grid (shown as Ref.)
3a. 15⁄16" T-bar grid (shown as Ref.)
4. ¼"-20 Threaded rod to structure (supplied and installed by others).
5. ¼"-20 Coupler hardware (supplied and installed by others).
6. 1" ¼"-20 Stud (by Selux).
7. Ø5⁄16" (Ø7mm) mounting hole.

T-Bar (TB and TBS) - Dimensions														
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		**"BB" (TB mtg.) Suspension Clips**	*** "C" Mid Suspension**		**"D" Feed Location**		**"E" Grid Spacing**	**"F" Wall Angle**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Quantity**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**		**Feet/Inch**	**mm**
***02 (2 ft.)**	1' - 11 13⁄16"	605	1' - 11"	583	0' - 1 5⁄8"	41	4x	1' - 4 3⁄4"	425	0' - 1 1⁄8"	29	2' Center to Center	1' - 10 3⁄4"	577
***04 (4 ft.)**	3' - 11 13⁄16"	1215	3' - 11"	1193	0' - 6 5⁄8"	156	6x	2' - 10 3⁄4"	882	0' - 2 1⁄8"	54	4' Center to Center	3' - 10 3⁄4"	1187
***05 (5 ft.)**	4' - 11 13⁄16"	1519	4' - 11"	1497	0' - 6 5⁄8"	156	6x	3' - 10 3⁄4"	1187	0' - 2 1⁄8"	54	5' Center to Center	4' - 10 3⁄4"	1491
***06 (6 ft.)**	5' - 11 13⁄16"	1825	5' - 11"	1803	0' - 6 5⁄8"	156	6x	4' - 10 3⁄4"	1492	0' - 2 1⁄8"	54	6' Center to Center	5' - 10 3⁄4"	1787
***08 (8 ft.)**	7' - 11 13⁄16"	2434	7' - 11"	2412	0' - 6 5⁄8"	156	8x	6' - 10 3⁄4"	2101	0' - 2 1⁄8"	54	8' Center to Center	7' - 10 3⁄4"	2406

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.
*For other lengths consult factory

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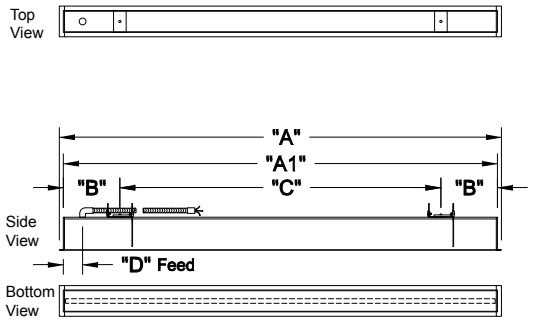
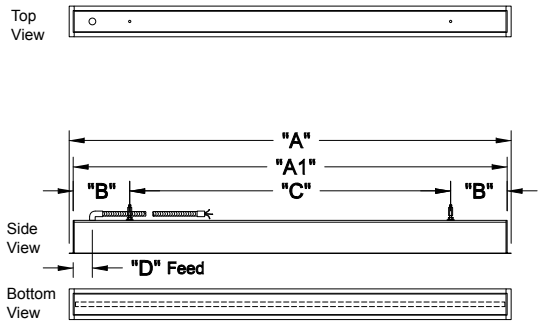
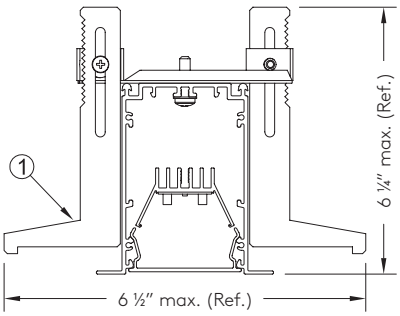
Rotating Crossbar Mounting (RC)



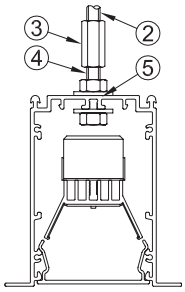
¼"-20 Threaded Stud Mounting (TS)



Rotating Crossbars (RC)
(¼" to 2" thick ceiling)



¼"-20 Threaded Stud (TS)
(1" Threaded Stud)



1. Rotating Crossbar intended for inaccessible ceilings, adjustable for ceiling thickness of ¼" to 2".
2. ¼"-20 Threaded rod to structure (supplied and installed by others).
3. ¼"-20 Coupler hardware (supplied and installed by others).
4. 1" ¼"-20 Stud (by Selux).
5. Ø5⁄16" (Ø7mm) mounting hole.

Rotating Crossbar (RC) and Threaded Stud (TS) - Dimensions												
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		*** "C" Mid Suspension**		**"D" Feed Location**		**"E" Wall Angle**	
	Feet/Inch	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**	**Feet/Inch**	**mm**
02 (2 ft.)	2' - 1 1⁄8"	638	2' - ¼"	616	0' - 1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105	2' - 0"	610
03 (3 ft.)	3' - 1 1⁄8"	942	3' - ¼"	921	0' - 6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54	3' - 0"	914
04 (4 ft.)	4' - 1 1⁄8"	1247	4' - ¼"	1226	0' - 6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54	4' - 0"	1219
05 (5 ft.)	5' - 1 1⁄8"	1552	5' - ¼"	1530	0' - 6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54	5' - 0"	1524
06 (6 ft.)	6' - 1 1⁄8"	1857	6' - ¼"	1835	0' - 6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54	6' - 0"	1829
07 (7 ft.)	7' - 1 1⁄8"	2162	7' - ¼"	2140	0' - 6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54	7' - 0"	2134
08 (8 ft.)	8' - 1 1⁄8"	2466	8' - ¼"	2445	0' - 6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54	8' - 0"	2438

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

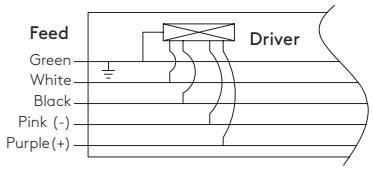
0-10V linear dimming (DM10)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 10%.

* For control recommendations, please contact driver manufacturer.

Driver Quantity							
Light Engine	**2ft**	**3ft**	**4ft**	**5ft**	**6ft**	**7ft**	**8ft**
1C20	1						
1C25	1					1	
1C30	1				1		
1C35	1				1	2	1
1C40	1				1	2	2
1C45	1			2	1	2	

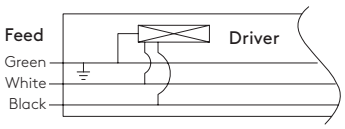
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED ECOdrive (DIL)
DALI-2 logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

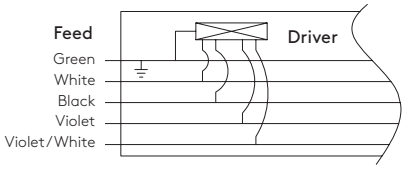


Standard Wiring supplied for all drivers	Green = Ground White = Neutral (120V/277V/347V) or L2 (240V) Black = Hot/L1 (120V-347V)
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED, D01, DL01	Pink = (-) DALI-2 or 0-10V Dimming Control Purple = (+) DALI-2 or 0-10V Dimming Control
DC2	No additional wires
DE1	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)



Lutron EcoSystem (DE1)



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage			
Driver	**Light Engine**	**Nominal W/ft**	
		120V	**277V**
DM10	1C20	4.9	5.3
	1C25	6.1	6.5
	1C30	7.3	7.7
	1C35	8.7	8.9
	1C40	9.9	10.1
	1C45	11.1	11.3

Emergency Wiring (EC) - EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

* For 2' to 6' nominal luminaires, the entire fixture is wired for operation on emergency circuit.

* For 7' and up nominal luminaires, the first 4' nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

* If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

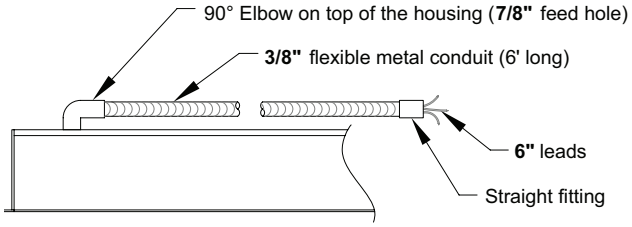
Separate Switching (SS) - Luminaires available with separately switched 4' (nominal) sections starting at 7' and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

* All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

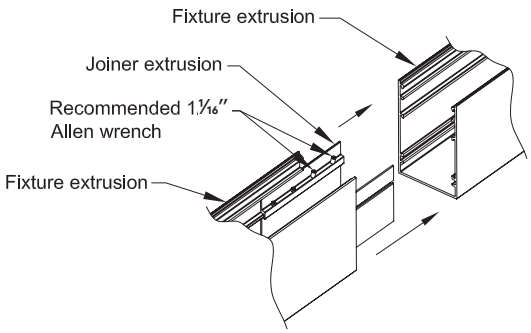
* To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

* If the project requires different separate switching than outlined above please consult the factory.

Flex Whip - standard for recessed fixtures



Joiner System - standard for Runs and Configurations



Standard Recessed (W60) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

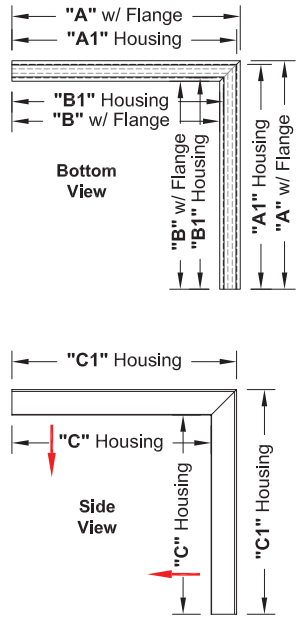
The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

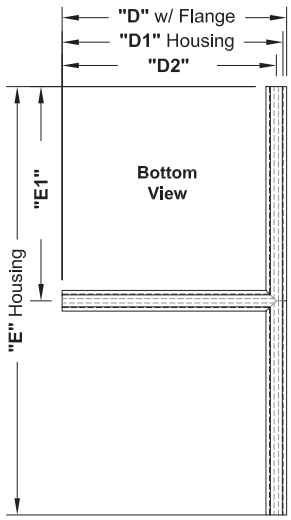
Project Specific Recessed (W60) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

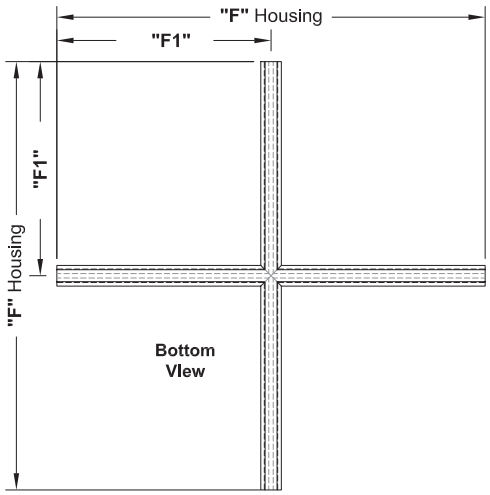
L9 - Lit Horizontal Corner



T9 - Lit "T" Section



X9 - Lit "X" Section



Recessed (W60) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
"A" Housing (Outside)	2' - 1 1/4"	642						
"A1" Housing (Inside)	1' - 10 15/16"	582						
"B" Housing (Outside)			1' - 11 1/2"	597				
"B1" Housing (Inside)			2' - 3 1/16"	688				
"C" Housing (Inside)					2' - 1 1/4"	642		
"C1"					2' - 1/8"	612		
"D" Housing					4' - 3/16"	1224		
* "D1"					2' - 1/8"	612		
"E" Housing							4' - 3/16"	1224
"E1"							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Standard Recessed (W6R1/2) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions please consult the factory.

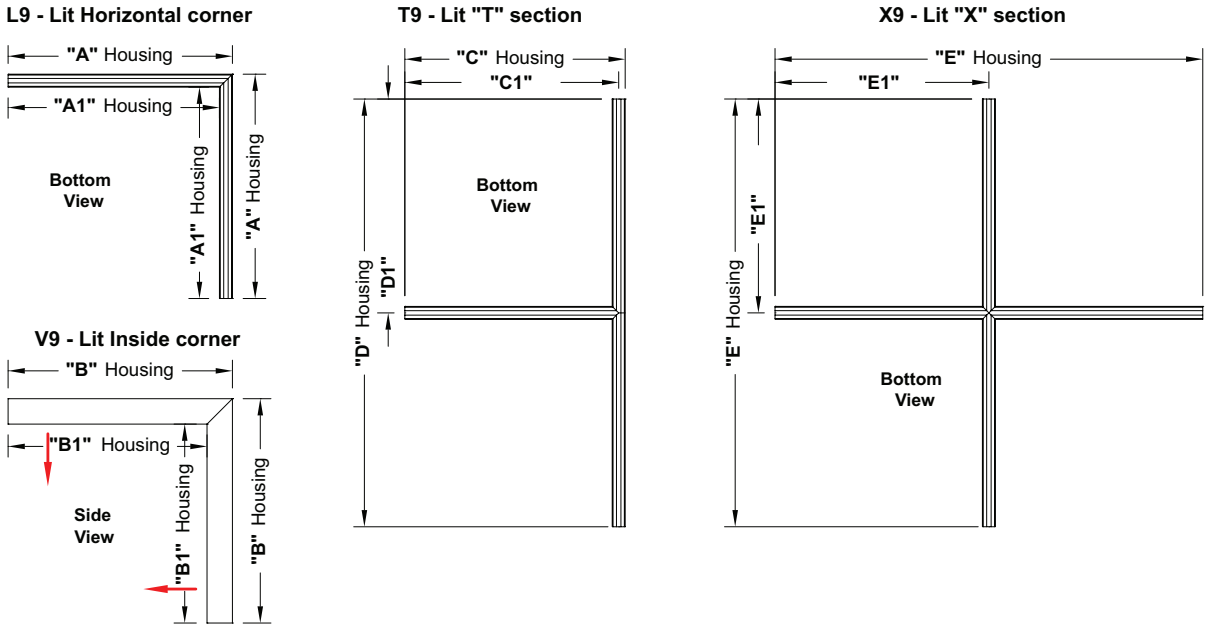
The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example, leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example, 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

Project Specific Recessed (W6R1/2) shapes/configurations:

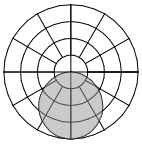
Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.



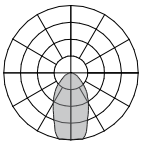
Recessed (W6R1/R2) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm	Feet/Inch	mm
"A" w/Flange (Outside)	2' - 1 3/4"	654						
"A1" Housing (Outside)	2' - 1 1/4"	642						
"B" w/Flange (Inside)	1' - 10 7/16"	570						
"B1" Housing (Inside)	1' - 10 15/16"	582						
"C" Housing (Inside)			2' - 3 1/16"	688				
"C1" Housing (Outside)			1' - 11 1/2"	597				
"D" w/Flange					2' - 1 3/4"	654		
"D1" Housing					2' - 1 1/4"	642		
"D2"					2' - 1/8"	612		
"E" Housing					4' - 3/16"	1224		
"E1"					2' - 1/8"	612		
"F" Housing							4' - 3/16"	1224
"F1"							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

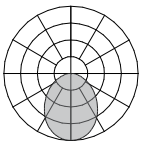
Photometry



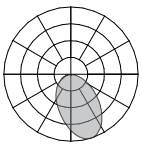
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81



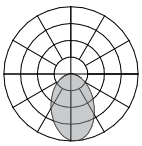
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2819	705	8.5	83



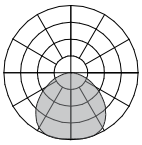
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3372	843	8.5	99



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3483	871	8.5	102



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2764	691	8.5	81

W60 Recessed	
CCT Multiplier	
5500K	0.98
5000K	1.00
4000K	0.95
3500K	0.97
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

ELT-05

Photometric Report (Type C)

Filename: L60W-1C30-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C30-35-LW-X-04-XX-UNV

Maximum Candela = 867.145977666378 at 0 H 2.5 V

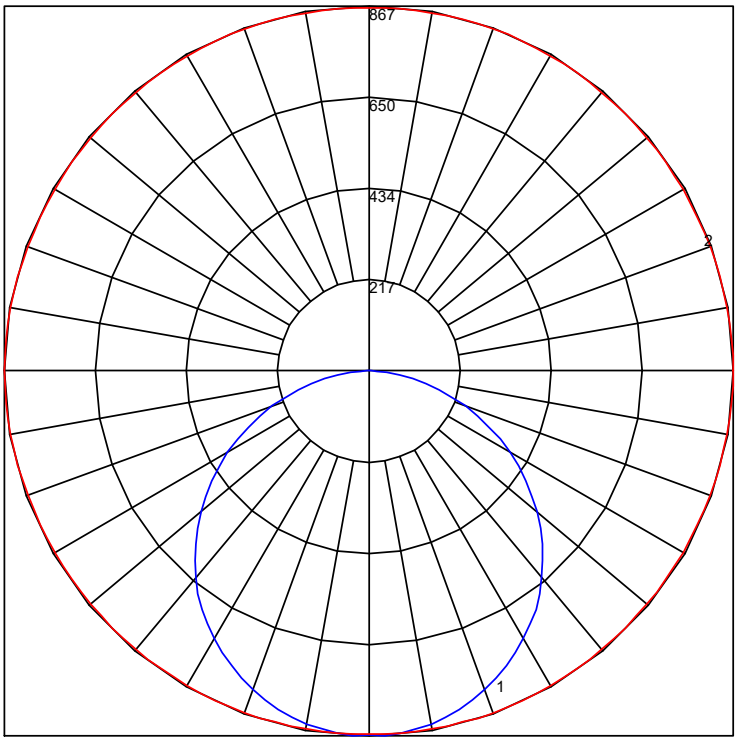
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 64
Maximum UGR: 27.5
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



Photometric Report (Type C)

Filename: L60W-1C30-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C30-35-LW-X-04-XX-UNV

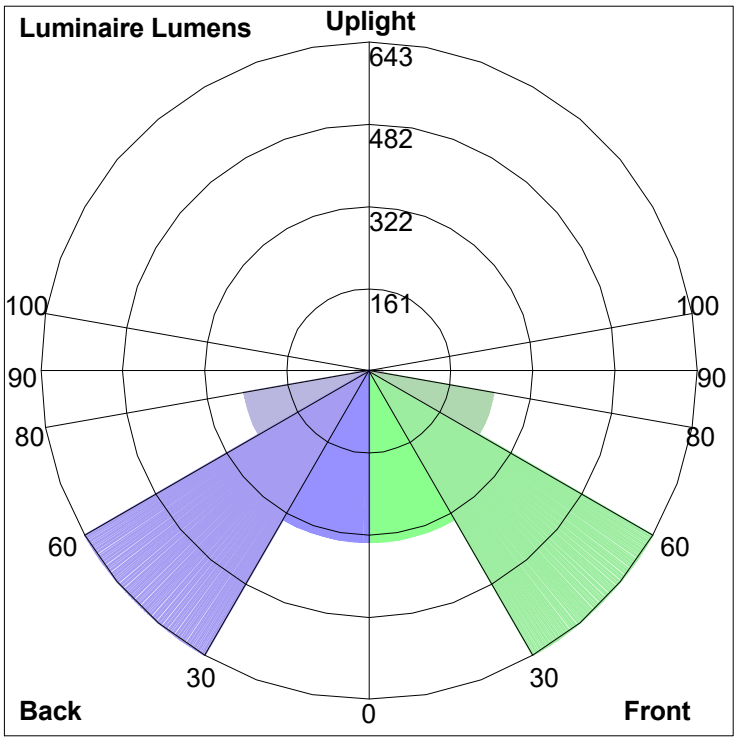
Maximum Candela = 867.145977666378 at 0 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 64
Maximum UGR: 27.5
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	335.4	N.A.	13.4
FM (30-60)	643.3	N.A.	25.6
FH (60-80)	248.3	N.A.	9.9
FVH (80-90)	27.1	N.A.	1.1
BL (0-30)	335.4	N.A.	13.4
BM (30-60)	643.3	N.A.	25.6
BH (60-80)	248.3	N.A.	9.9
BVH (80-90)	27.1	N.A.	1.1
UL (90-100)	0.7	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	2508.9	N.A.	100.0
BUG Rating	B1-U1-G1		



Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

Maximum Candela = 573.374156096399 at 0 H 2.5 V

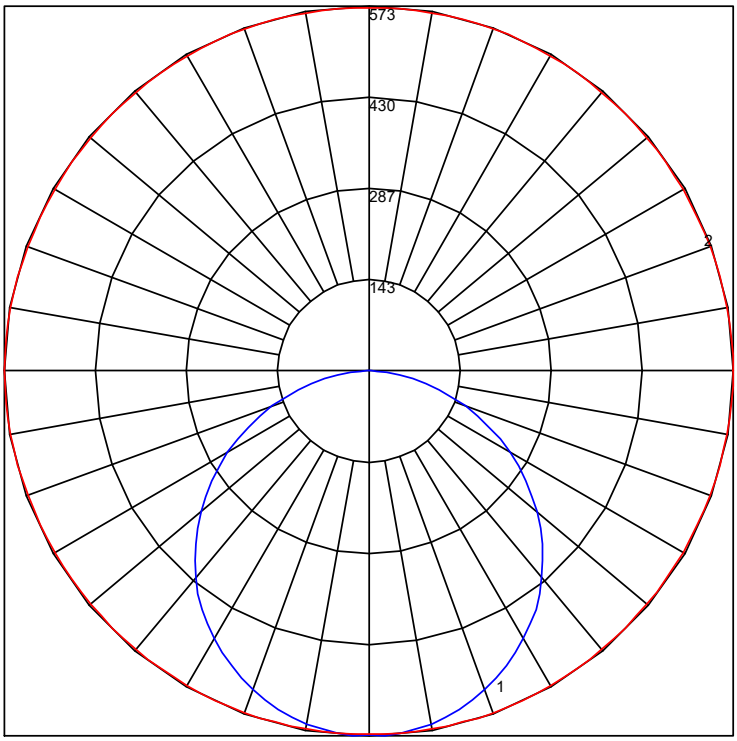
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

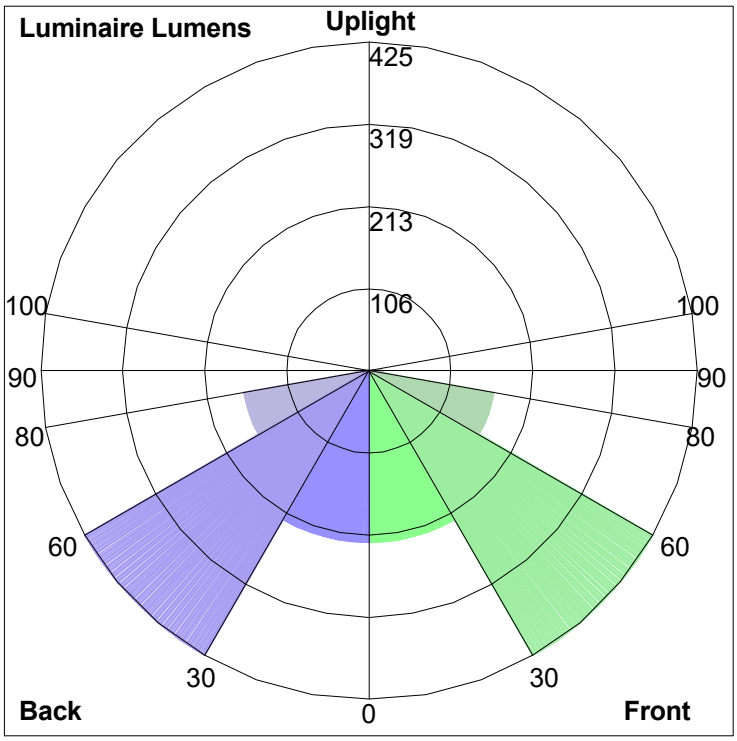
Maximum Candela = 573.374156096399 at 0 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	221.8	N.A.	13.4
FM (30-60)	425.3	N.A.	25.6
FH (60-80)	164.2	N.A.	9.9
FVH (80-90)	17.9	N.A.	1.1
BL (0-30)	221.8	N.A.	13.4
BM (30-60)	425.3	N.A.	25.6
BH (60-80)	164.2	N.A.	9.9
BVH (80-90)	17.9	N.A.	1.1
UL (90-100)	0.4	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1658.8	N.A.	100.0
BUG Rating	B1-U1-G1		



ELT-05B

Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

Maximum Candela = 573.374156096399 at 0 H 2.5 V

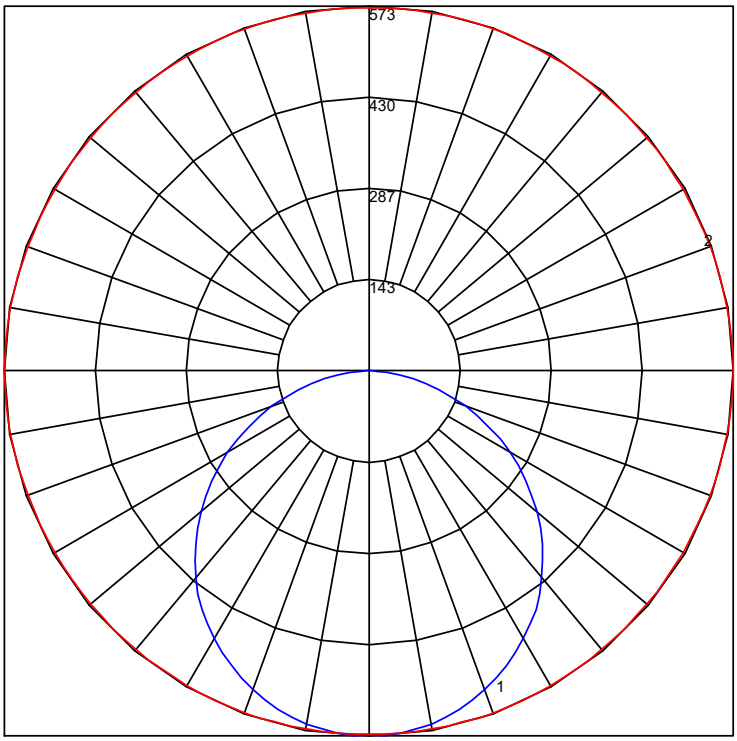
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



ELT-05B

Photometric Report (Type C)

Filename: L60W-1C20-35-LW-X-04-XX-UNV.ies
[TEST] prorated from 11685012.01B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/19/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-LW-X-04-XX-UNV

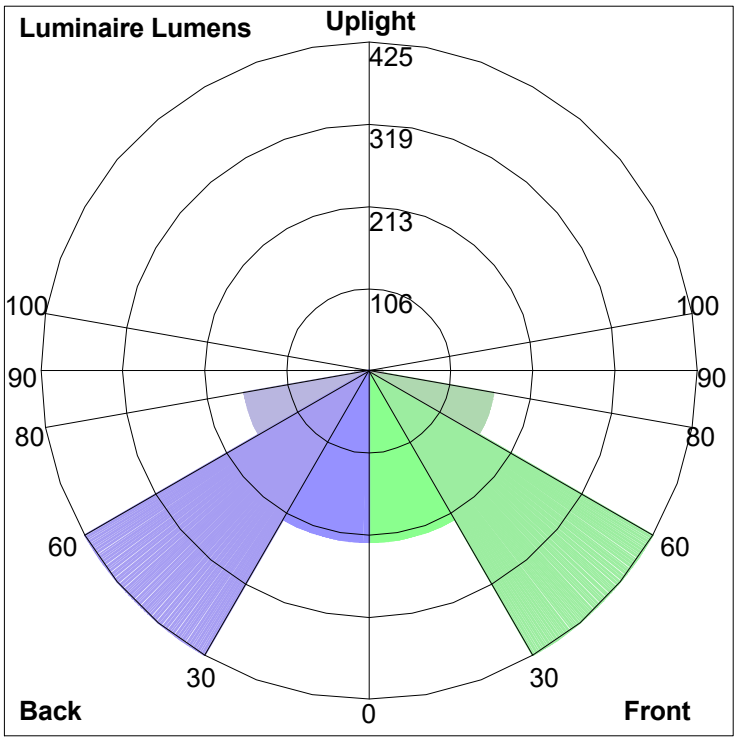
Maximum Candela = 573.374156096399 at 0 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 86
Maximum UGR: 26.1
Indoor Classification: Direct
BUG Rating : B1-U1-G1

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	221.8	N.A.	13.4
FM (30-60)	425.3	N.A.	25.6
FH (60-80)	164.2	N.A.	9.9
FVH (80-90)	17.9	N.A.	1.1
BL (0-30)	221.8	N.A.	13.4
BM (30-60)	425.3	N.A.	25.6
BH (60-80)	164.2	N.A.	9.9
BVH (80-90)	17.9	N.A.	1.1
UL (90-100)	0.4	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1658.8	N.A.	100.0
BUG Rating	B1-U1-G1		



NANO-X

Micro Profile Exterior LED Task and Cove Fixture

Customer: Date: Type:

Project:

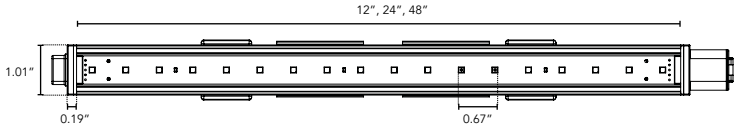
- Compact, variable light fixture.
- Fixture comes in 1ft, 1.5f, 2ft, and 4 feet to allow 6" incremental builds.
- Many options in color temperature to suit a range of projects, call factory for additional options
- Uses standard line voltage dimming.
- Patented CleanDim technology ensures even dimming from 0% - 100%.
- Fixtures are compatible with both forward and reverse phase dimming or can use Boca's SDS module for 0-10V, DALI or DMX Dimming.
- The housing is an anodized aluminum with tempered.
- Glass lens for enhanced durability in demanding installations.
- Total linear feet per power feed (6W); 76 ft. @ 120V or 156ft. @ 277V
- NanoX is Exterior IP65 rated.
- Contact Boca Flasher for tips with custom installation procedures.

PRODUCT SPECIFICATIONS:

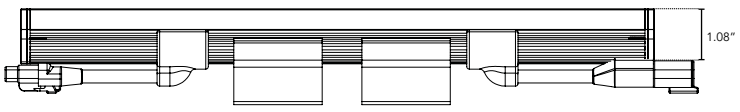
	WATTAGE	COLOR OPTION	VOLTAGE	OPTIC	FINISH	MOUNTING	RATINGS	LENS
Nano-X					A			
	3W	**2000K**	**120V**	**15°x45°**	**A** Clear Anodized Aluminum	**F** Fixed	**I** Interior-IP50	**C** Clear
	6W	**2400K**	**277V**	**120°**		**H** Hinge	**E** Exterior-IP65	**LD** Light Diffused
		2700K						
		3000K						
		3500K						
		4000K						
		5000K						
		6500K						

DIMENSIONS:

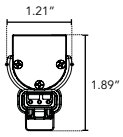
Plan View



Elevation View



End View



Boca Flasher, Inc. 508 South Military Trail, Deerfield Beach, Florida 33442 USA Phone: 561.989.5338 Fax: 561.982.8323

NANO-X

Micro Profile Exterior LED Task and Cove Fixture

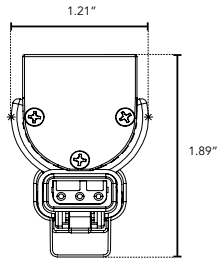
TECHNICAL SPECIFICATIONS:

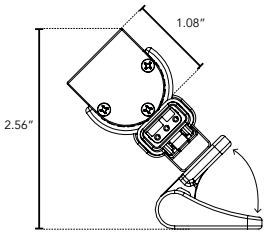
WATTAGE	3 or 6 watts per linear ft.
INPUT VOLTAGE	90-120V 230-227V
CONTROL	Leading Edge/Trailing Edge line dimmer 0-10V, DALI, or DMX*
POWER CABLE	UL Standard 10 ft.
PIXEL SPACING	5/8" on center
LENGTH	1 ft., 1.5', 2ft., and 4 ft, allow 1/4" for each end cap and 1.25" for power feed cable
TOTAL WIDTH	1.21" Fixed Clip
TOTAL HEIGHT	1.89" Fixed Clip
INPUT CURRENT	54mA @ 120V 24mA @ 277V
COLOR OPTIONS	2000K, 2400K, 2700K, 3000K, 3500K, 4000K, 5000K, 6500K
MOUNTING	Fixed Clip, Hinge
AVAILABLE OPTICS	120°, 15° x 45°
RATING	IP50 Dry, IP65 Exterior
COLOR RENDERING INDEX (CRI)	90 + CRI
ENVIRONMENTAL	Operating temperature--40°F-140°F Ambient(-40°C-60°C)** Storage temperature -40°F-140°F Ambient indoor fixtures operation limited to =<50% relative humidity

*Uses Boca SDS Module for 0-10V, Dali, or DMX Dimming.
* Military spec available under special request-lead times may be impacted.

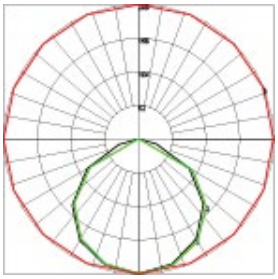
MOUNTING INFORMATION:

- For vertical installation please contact the factory for specific mounting instructions.
- For installations above 4' please contact the factory.





LUMINAIRE INFORMATION:



Fixture Type: 3500°K, 120° optic, 120V, 12"

Total lumen Output: 2290 Lumens per 4ft.

Luminaire Efficacy: 93 Lumens per watt

Characteristics:

LUMENS PER LAMP	572.6 (1 lamp)
TOTAL LAMP LUMENS	572.6
LUMINAIRE LUMENS	573
TOTAL LUMINAIRE EFFICIENCY	100%
LUMEN EFFICACY RATING	93
TOTAL LUMINAIRE WATTS	6.15
BALLAST FACTOR	1.00
CIE TYPE	Direct
SPACING CRITERION (0-180)	1.28
SPACING CRITERION (90-270)	1.30
SPACING CRITERION (Diagonal)	1.40
BASIC LUMINOUS SHAPE	Rectangular
LUMINOUS LENGTH (0-180)	0.31m
LUMINOUS WIDTH (90-270)	0.01m
LUMINOUS HEIGHT	0.00m

Boca Flasher, Inc. 508 South Military Trail, Deerfield Beach, Florida 33442 USA Phone: 561.989.5338 Fax: 561.982.8323

Photometric Report (Type C)

Filename: L60W-1C20-35-MI-X-04-XX-UNV.ies
[TEST] prorated from 11685012.05B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/5/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-MI-X-04-XX-UNV

Maximum Candela = 1190.1696543383 at 0 H 10 V

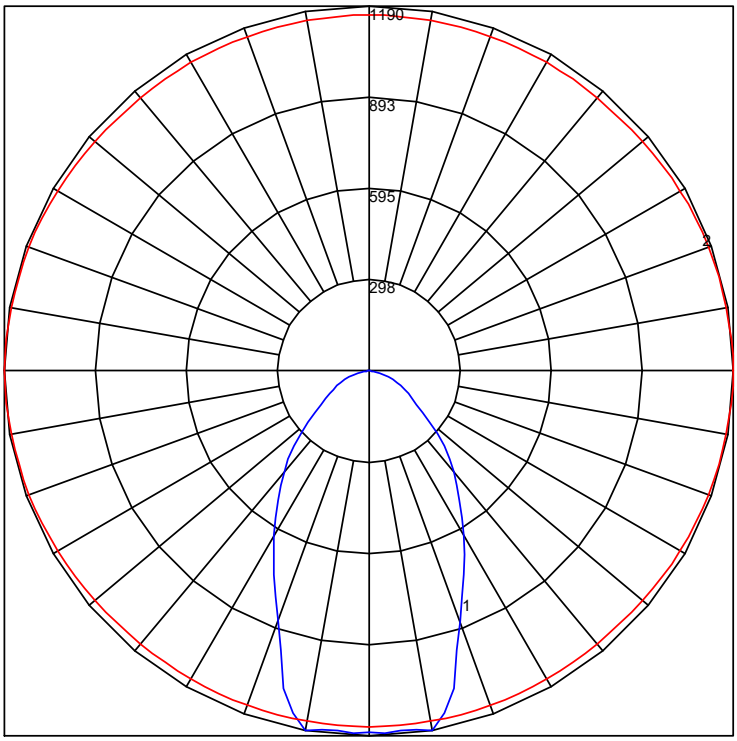
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 100
Maximum UGR: 21.1
Indoor Classification: Direct
BUG Rating : B1-U0-G0

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 10 Vertical



ELT-06

Photometric Report (Type C)

Filename: L60W-1C20-35-MI-X-04-XX-UNV.ies
[TEST] prorated from 11685012.05B20
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 4/5/2017 (pro-rated)
[MANUFAC] Selux Corporation
[LUMCAT] L60W-1C20-35-MI-X-04-XX-UNV

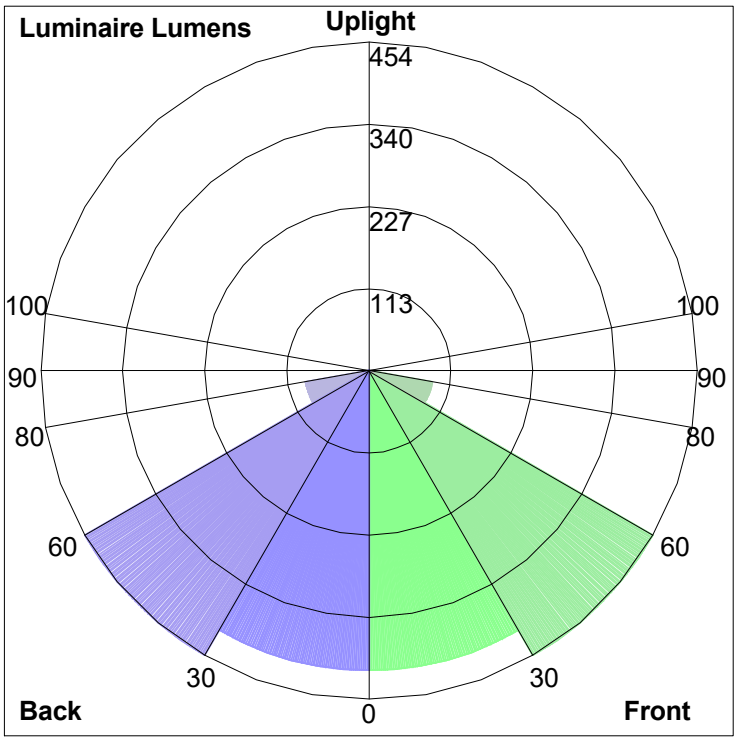
Maximum Candela = 1190.1696543383 at 0 H 10 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 100
Maximum UGR: 21.1
Indoor Classification: Direct
BUG Rating : B1-U0-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	413.5	N.A.	21.5
FM (30-60)	453.5	N.A.	23.6
FH (60-80)	88.7	N.A.	4.6
FVH (80-90)	6.1	N.A.	0.3
BL (0-30)	413.5	N.A.	21.5
BM (30-60)	453.5	N.A.	23.6
BH (60-80)	88.7	N.A.	4.6
BVH (80-90)	6.1	N.A.	0.3
UL (90-100)	0.0	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	1923.6	N.A.	100.0
BUG Rating	B1-U0-G0		



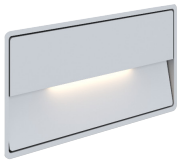
[MP LIGHTING]

L770

EXTERIOR | INTERIOR

Trimless Steplight | For walls, stairs, and walkways.

- Wet, Damp, and Dry location



Ordering Information

Clear Form

Date :

Quantity :

Project : Compton College -VAPA

Note :

Type : ELT-7

Specifications

Luminaire | Example Code: L770-6-W30H-WH

Product	Version	CCT & CRI [1]	Finish [2]
L770			
	3 3W	**W22S** 2200K 80+	**Aluminum Finishes:**
	6 6W	**W27H** 2700K 90+	**MA** matte clear anodized
		W30H 3000K 90+	**BK** black powder coated
		W35H 3500K 90+	**WH** white powder coated
		W41H 4100K 90+	**BZ** bronze powder coated

System Components (Ordered Separately)

Remote Driver :

* Consult factory for the alternative option of using remote driver.

Important Notes

Specifications

1. *Refer to pg.02 - for Colour Consistency details.*
2. *Refer to Appendix or MP Lighting website for complete look of luminaire with different finish options.*

Warranty Notes & Disclaimer

Malfunction and damage to product due to incompatible dimming system or misuse will not be covered under warranty. Consult MP Lighting for recommended drivers. If the fixture has an option to be installed with a dimming control system, consult a dimming system manufacturer with minimum load before installing. MP Lighting reserves the right, at its sole discretion, at any time and without notice, to make design changes to any of our products. Consult MP Lighting website for most updated documentation.

L770

EXTERIOR | INTERIOR
Trimless Steplight | For walls, stairs, and walkways.

- Wet, Damp, and Dry location

Performance

Wattage	Forward Current	Power Consumption Budget per fixture (including driver)	LED output (Source)	Fixture Output (Delivered)
3W	350mA	4W	330 lm	29 lm
6W	700mA	8W	660 lm	53 lm

Application

Environment	Dry / Damp / Wet Location approved. IP 66.
Mounting	Recessed mount to MP Lighting Single Gang Box (EBX-SGB1, included). **Box dimension: Length** | 4-3/8" (111mm) X **Width** | 2-5/8" (66mm) X **Height (depth)** | 2-5/16" (74mm)

Electrical

Power Supplies	Integral LED drivers (120V AC input, **Non-dimmable**) Consult factory for Integral LED drivers (120-277V AC input, **ELV / 0-10V dimmable**) or alternative driver options and remote driver options.
Control	**On/off control** **Dimming:** ELV or 0-10V dimming with appropriate drivers **Other options (consult factory):** TRIAC/MLV, DMX, DALI, Casambi, Power over Ethernet

Luminaire Construction

LED Light Source	**W22S =** CCT: 2200K, CRI (Ra): 80+, Colour Consistency: 3SDCM **W27H =** CCT: 2700K, CRI (Ra): 90+, Colour Consistency: 2SDCM **W30H =** CCT: 3000K, CRI (Ra): 90+, Colour Consistency: 2SDCM **W35H =** CCT: 3500K, CRI (Ra): 90+, Colour Consistency: 3SDCM (Contact factory for 2SDCM option) **W41H =** CCT: 4100K, CRI (Ra): 90+, Colour Consistency: 3SDCM
Weight	1.5lbs (0.68kg)
Material	**Fixture:** machined marine-grade aluminum with polycarbonate lens
Supplied with	**Installation:** Back box and mounting kit: mounting bracket, mounting screws x 2, mounting plage, foam/tape, threaded rod, washer, and nut **Driver:** Non-dimmable integral driver and single gang box.
Warranty & LED Life	5 years limited warranty Estimated useful life of LED is 50,000 hours.

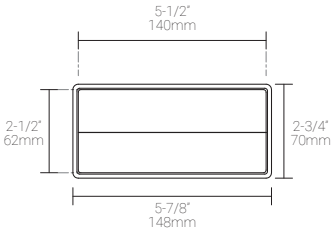
Ordered Separately

System Components	**Power supplies:** alternate remote driver for dimming options Please consult factory or visit Recommended Drivers for available driver options.

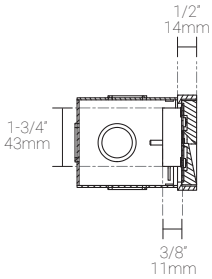
Mounting Options & Dimensions

LED Insert Dimensions

Fixture

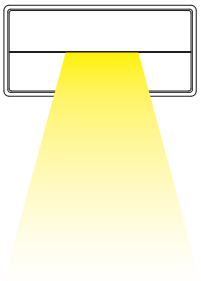


Side View



3D View

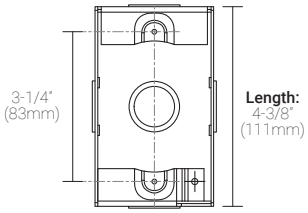
Beam



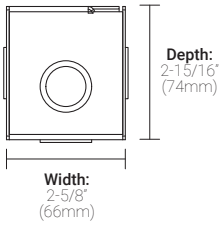
Back Box Dimensions

MP Lighting Single Gang Back Box | Order Code: EBX-SGB1

Top View

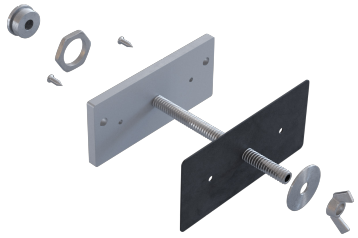


Side View

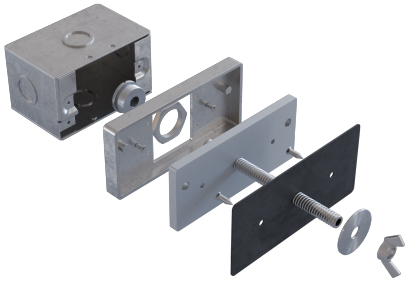


MK1 | For walls and stairs

Mounting Kit Exploding Views



MK1-L770



MK1-L770 shown with EBX-SGB1

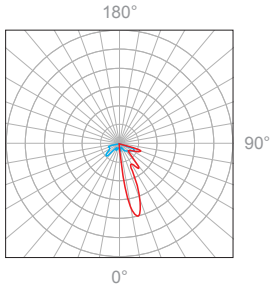
MK1-L770 shown with EBX-SGB1 and Plywood Form

Wall-mount Plywood Form Installation (shown with L770)

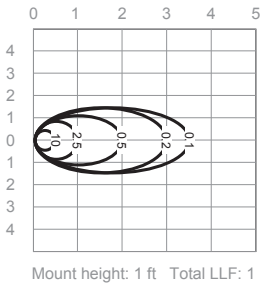
Stairs Plywood Form Installation (shown with L770)

3W, 3000K, 90+ CRI

Polar Candela Distribution



Isofootcandle Plot



Mount height: 1 ft Total LLF: 1

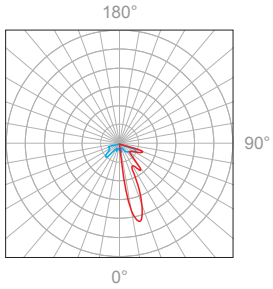
Illuminance at a Distance

Distance		Center Beam fc
0.5ft	0.15m	10fc
1.0ft	0.30m	2.5fc
2.0ft	0.61m	0.5fc
3.0ft	0.91m	0.2fc
3.5ft	1.07m	0.1fc

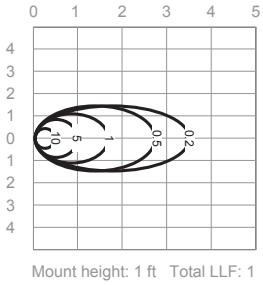
Delivered Lumen: 30.1lm
Vertical Beam Spread: 83.1°
Horizontal Beam Spread: 16.7°

6W, 3000K, 90+ CRI

Polar Candela Distribution



Isofootcandle Plot



Mount height: 1 ft Total LLF: 1

Illuminance at a Distance

Distance		Center Beam fc
0.5ft	0.15m	10fc
1.0ft	0.30m	5fc
1.6ft	0.49m	1fc
2.6ft	0.79m	0.5fc
3.5ft	1.07m	0.2fc

Delivered Lumen: 59.5lm
Vertical Beam Spread: 83.1°
Horizontal Beam Spread: 16.7°

Appendix

Aluminum Finishes

MA matte clear anodized

BK black powder coated

BZ bronze powder coated

WH white powder coated

Photometric Report (Type C)

Filename: L770-3W303H-S6.ies
[TEST] MP LIGHTING
[ISSUEDATE] 30/11/2019
[MANUFAC] MP LIGHTING
[LUMCAT] L770-3W303H-S6

Maximum Candela = 35.62 at 140 H 22 V

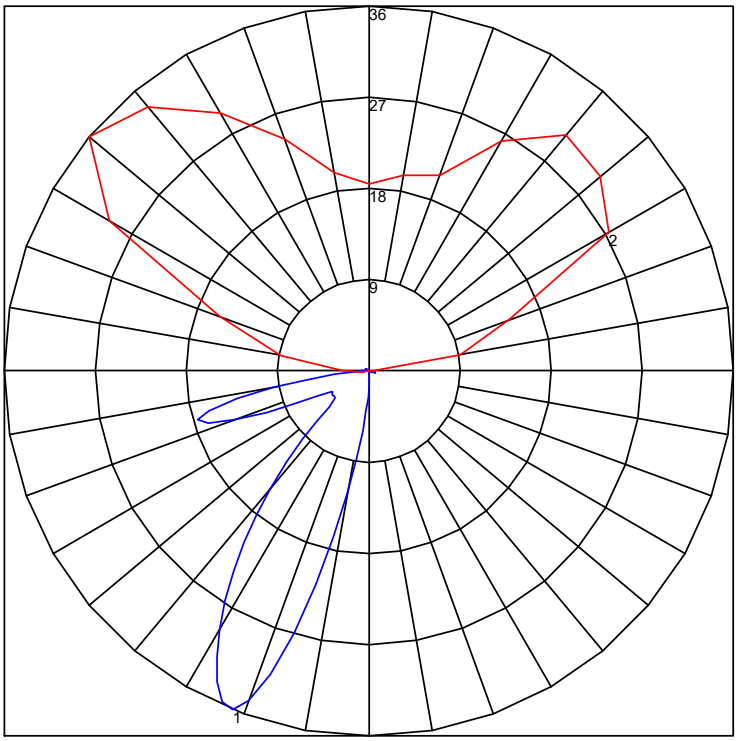
Classification:

Road Classification: N.A., N.A., Cutoff (deprecated)
Upward Wast Light Ratio: 0.03
Luminaire Efficacy Rating (LER): 10
Maximum UGR: 35.8
Indoor Classification: Direct
BUG Rating : B0-U1-G0

Polar Candela Curves:

Vertical Plane Through:
1) 140 - 320 Horizontal

Horizontal Cone Through:
2) 22 Vertical



Photometric Report (Type C)

Filename: L770-3W303H-S6.ies
[TEST] MP LIGHTING
[ISSUEDATE] 30/11/2019
[MANUFAC] MP LIGHTING
[LUMCAT] L770-3W303H-S6

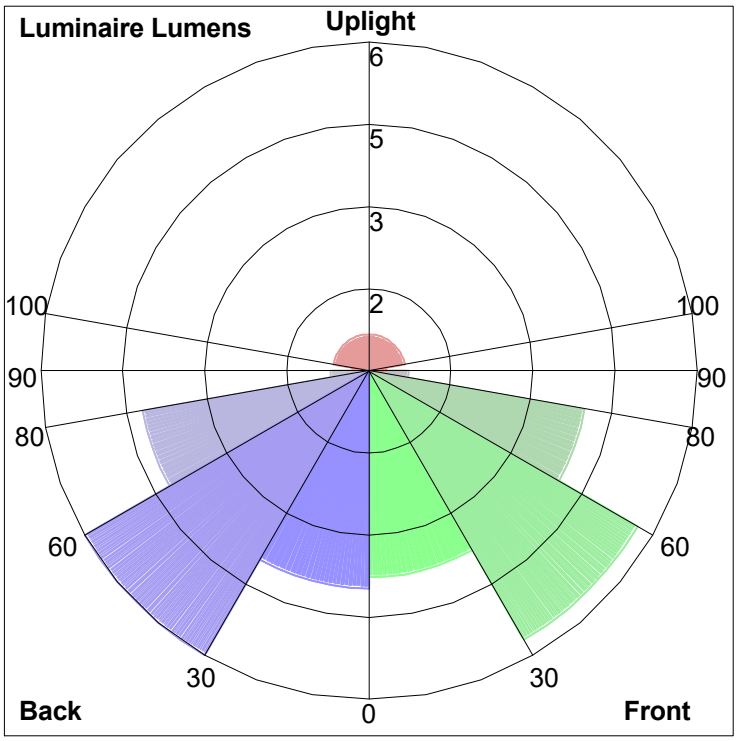
Maximum Candela = 35.62 at 140 H 22 V

Classification:

Road Classification: N.A., N.A., Cutoff (deprecated)
Upward Waste Light Ratio: 0.03
Luminaire Efficacy Rating (LER): 10
Maximum UGR: 35.8
Indoor Classification: Direct
BUG Rating : B0-U1-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	3.8	1.5	12.6
FM (30-60)	5.7	2.2	18.9
FH (60-80)	4.0	1.6	13.3
FVH (80-90)	0.7	0.3	2.4
BL (0-30)	4.0	1.6	13.2
BM (30-60)	6.0	2.4	20.0
BH (60-80)	4.2	1.7	14.0
BVH (80-90)	0.7	0.3	2.3
UL (90-100)	0.3	0.1	1.0
UH (100-180)	0.7	0.3	2.2
Total	30.1	12.0	100.0
BUG Rating	B0-U1-G0		



tivoli®

TRACE

VERTICAL

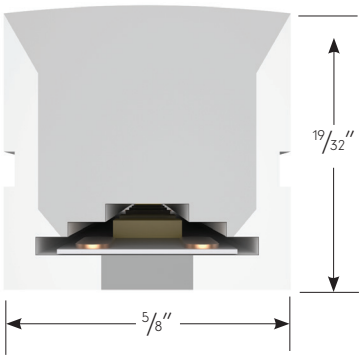
Project: _____ Type: _____

Product Features

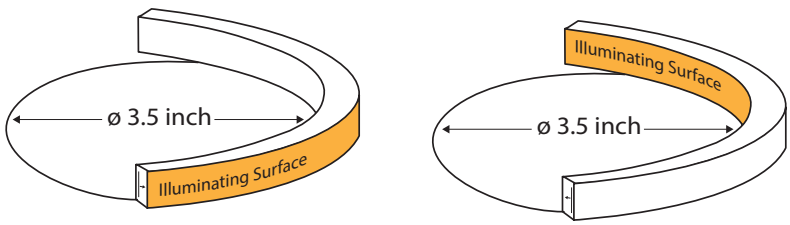
- Constructed using flexible SMD LEDs with zero voltage drop for reliability and uniformity of light
- Used to outline structures or applications where traditional glass neon is used
- Low Voltage 24V DC
- Available in Non-Dimming or Dimming version
- Long-life LEDs with tight cutting increments for precise field installation
- UV Stabilized for exterior use with silicone housing (no yellowing or cracking)
- IP67 Rating
- IK07 Rating - protected against 2 joules impact
- 1 Bin, 1.5 step color consistency

IK07 IP67 UL LISTED

Dimensions



TRACE Vertical Bending Direction



Convex/Concave Bending

www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

Order Specification Guide

NOTE: Lengths and quantity of each run must be submitted at time of order.
TRACE is factory prep only. In-field cutting will void warranty.

PRODUCT CODE		INTENSITY		PROFILE		LED COLOR		VOLTAGE
TRCE	-		-	**V**	-		-	**24**
TRCE = Trace Flexible Light		**L** = Low Output **S** = Standard Output **H** = High Output		**V** = Vertical		**24** = 2400K **27** = 2700K **30** = 3000K **35** = 3500K* **40** = 4000K **50** = 5000K* **GR** = Green* **BL** = Blue **RD** = Red **AM** = Amber*		**24** = 24V DC

*Special Order Option. Consult factory for lead time and MOQ.

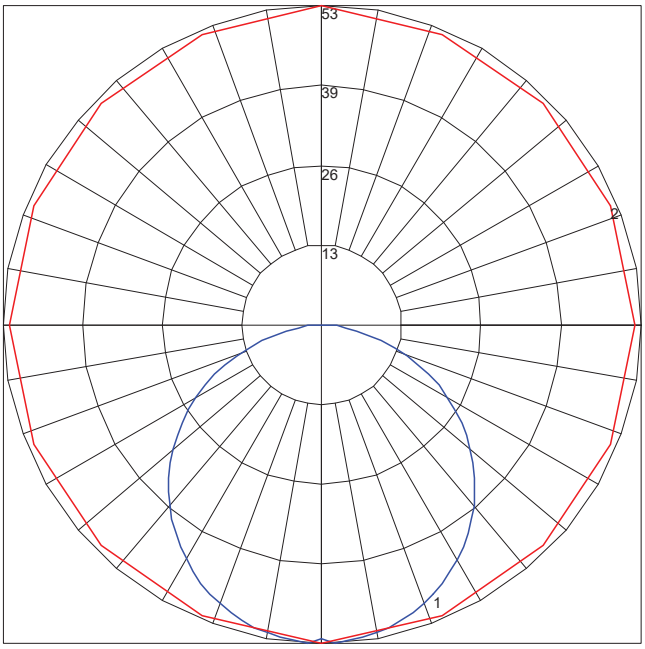
Specifications

Output (2700K)			
LED Intensity	**Low Output**	**Standard Output**	**High Output**
Lumens (lm/ft)	87	174	261
Beam Angle	115.8°		
Efficacy (lm/W)	58		
LEDs	2835		
CRI	>80		
Electrical			
Dimming	TRIAC, ELV, MLV, 0-10V, DMX		
Input Voltage	24V DC		
Power Consumption (W/ft)	1.5	3	4.5
Maximum Run	58'	29'	19'
Physical			
Dimensions	5/8" X 19/32"		
Cutting Increments	1.97"		
Material	UV, Solvent, Saltwater resistant silicone		
Wire Exit Options	Front, Side, Bottom		
LED PIN Temperature	60.9°C / 141.6°F		
Storage Temperature	-25°C / -13°F - 60°C / 140°F		
Ambient Temperature	Ta_{min} = -25°C / -13°F, Ta_{max}		
Certification and Testing			
Certification	UL		
Environment	Wet Location		
IP Rating	IP67		
IK Rating	IK07		
Warranty	3 Years		

- Maximum Run length refers to single side feed in serial connection
- The given color temperature is the strip (after coating) color temperature
- The given data are typical values due to the tolerances of the production process and electrical components; values for the light output and electrical power can vary up to 10%

Photometrics

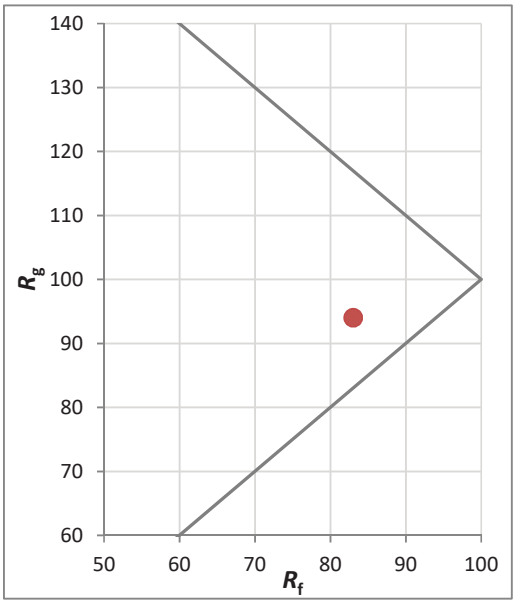
TRACE Vertical: Based on 2700K



Maximum Candela = 52.6
Located At Horizontal Angle = 90
Vertical Angle = 2.5
#1 Vertical Plane Through Horizontal Angles (90-270) (Through Max. Cd.)
#2 Vertical Cone Through Vertical Angle (2.5) (Through Max. Cd.)

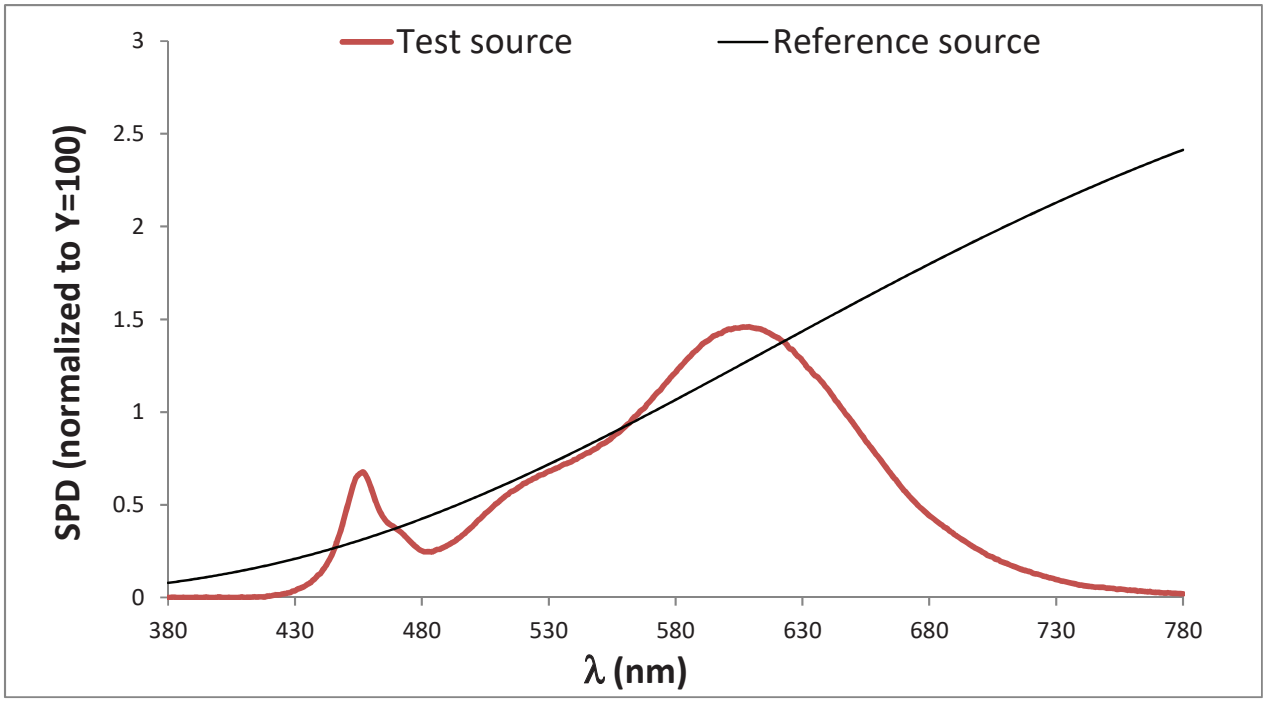
TM-30

		Graphic Shifts (%)	
Hue Bin	R_f	Chroma	Hue
1	77	-11%	1%
2	80	-8%	6%
3	80	-4%	9%
4	89	-3%	3%
5	92	-2%	3%
6	94	-1%	-2%
7	85	-7%	-3%
8	91	-5%	2%
9	84	-6%	7%
10	78	-3%	13%
11	80	2%	13%
12	84	7%	1%
13	85	3%	-9%
14	78	4%	-16%
15	83	-5%	-7%
16	73	-9%	-16%

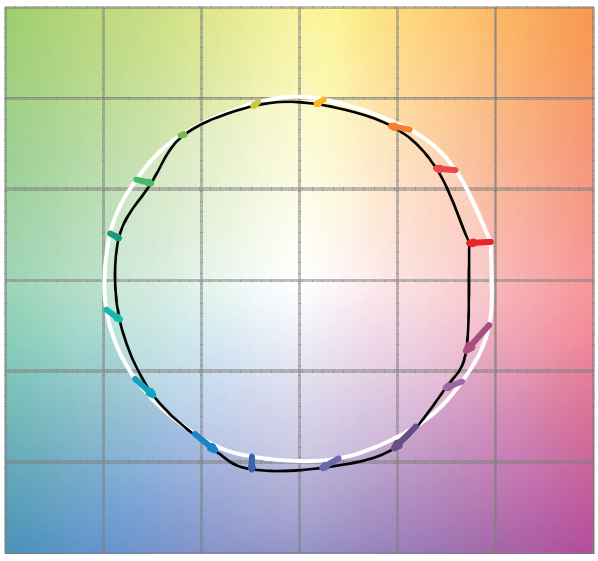


TM-30

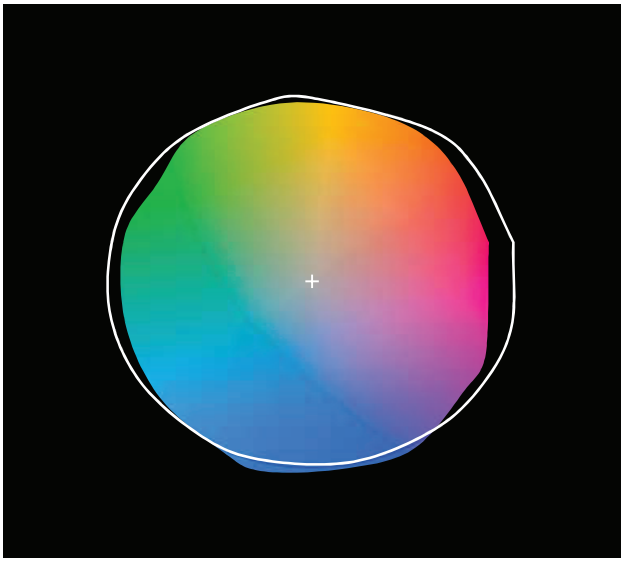
TRACE Vertical: Based on 2700K



Color Vector Graphic



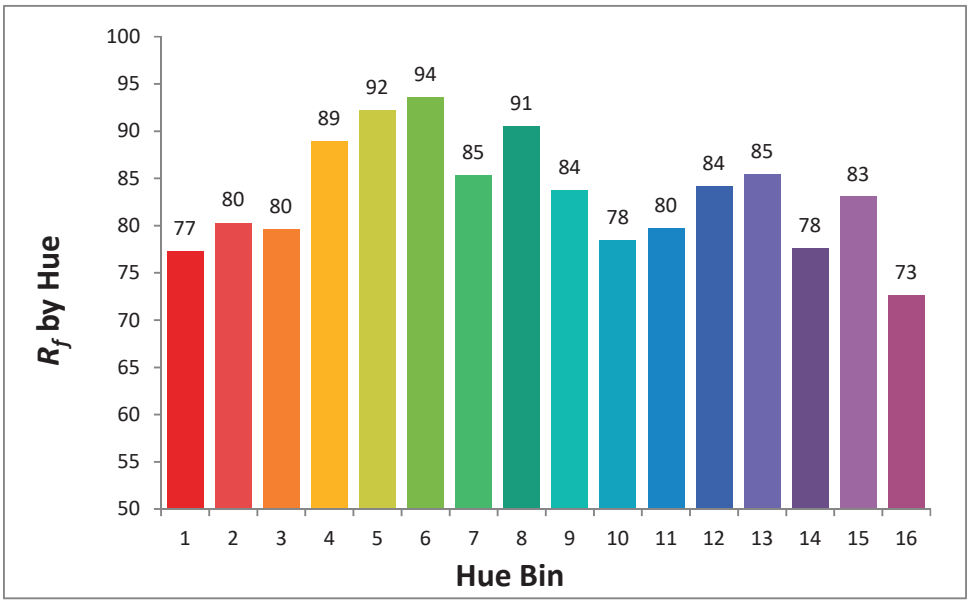
Color Distortion Graphic



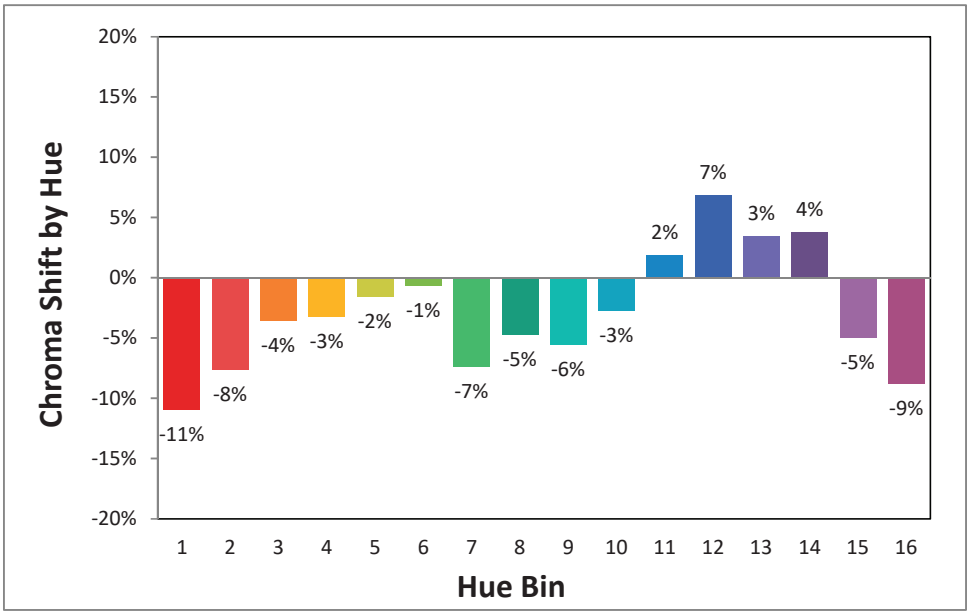
TM-30

TRACE Vertical: Based on 2700K

Hue Angle Bin vs. Fidelity Index

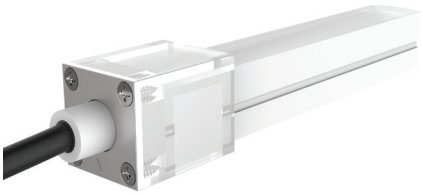


Hue Angle Bin vs. Change of Chroma



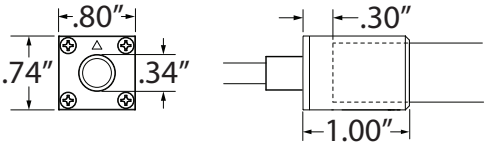
Power Lead Options - Vertical

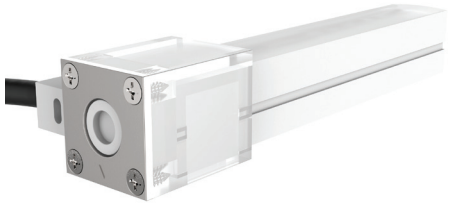
IP67: Rated for outdoor use and factory assembled.
Note: The end cap is made of UV stabilized polycarbonate, which produces no yellowing and cracking over time.



TRACE LEAD - FRONT

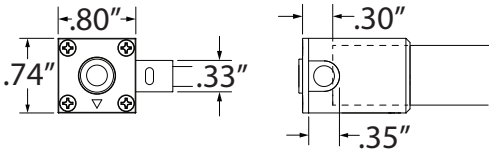
Vertical Front Lead Entry
5' Power Lead Cable with End Cap





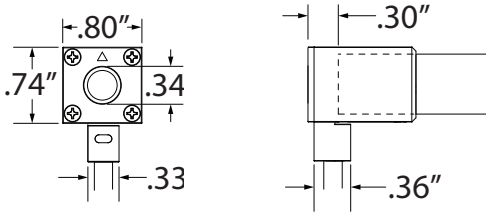
TRACE LEAD - SIDE

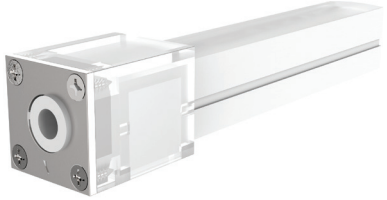
Vertical Side Lead Entry
5' Power Lead Cable with End Cap



TRACE LEAD - BOTTOM

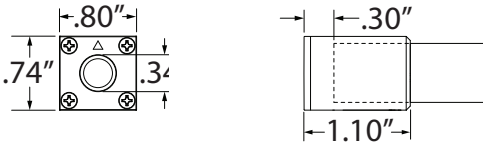
Vertical Bottom Lead Entry
5' Power Lead Cable with End Cap





TRACE END CAP

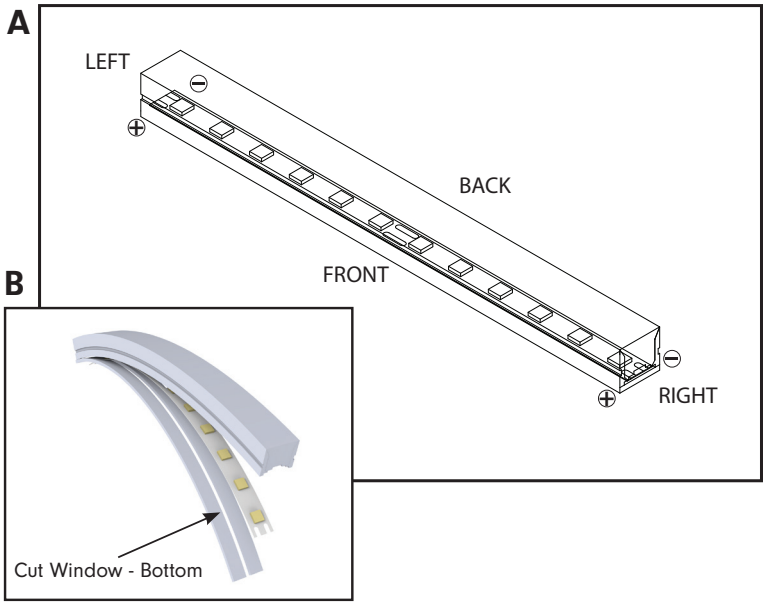
Vertical End Cap (No Lead)
1 pc End Cap with 4 Screws



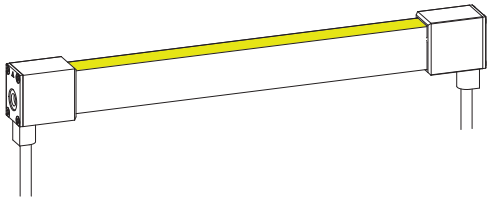
Power Leads - How to Configure

It is important to note the orientation of TRACE and what is considered Left Facing and Right Facing. TRACE is polarity specific and proper submission of power leads for each run is necessary for factory prep standards.

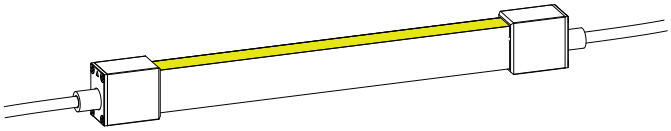
VERTICAL TRACE - The cut window will always indicate as Bottom (Image B) and positive (+) politarity will indicate front facing (Image A).



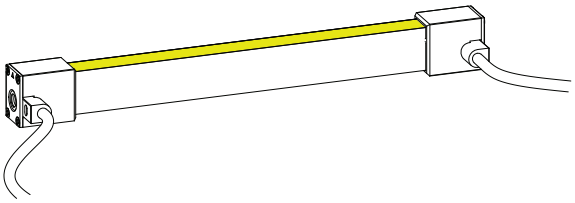
Power Lead Configurations



TRCE-V-LEAD-B-B
Left Facing Bottom Lead with 5′ Power Cable to Right Facing Bottom Lead with 5′ Power Cable

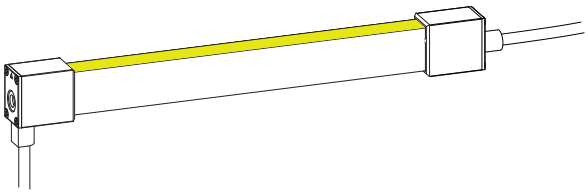


TRCE-V-LEAD-F-F
Left Facing Front Lead with 5′ Power Cable to Right Facing Front Lead with 5′ Power Cable

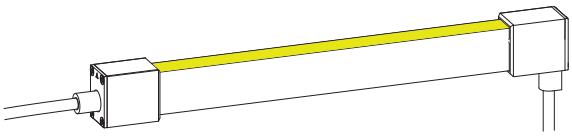


TRCE-V-LEAD-S-S
Left Facing Side Lead with 5′ Power Cable to Right Facing Side Lead with 5′ Power Cable

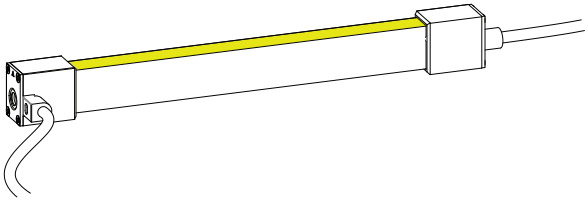
Power Lead Configurations



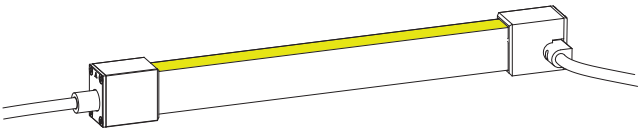
TRCE-V-LEAD-B-F
Left Facing Bottom Lead with 5′ Power Cable to
Right Facing Front Lead with 5′ Power Cable



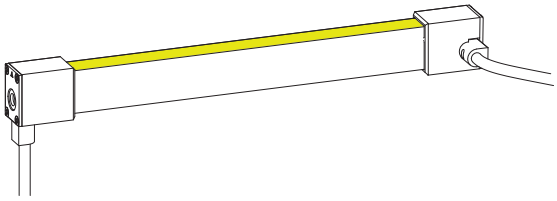
TRCE-V-LEAD-F-B
Left Facing Front Lead with 5′ Power Cable to
Right Facing Bottom Lead with 5′ Power Cable



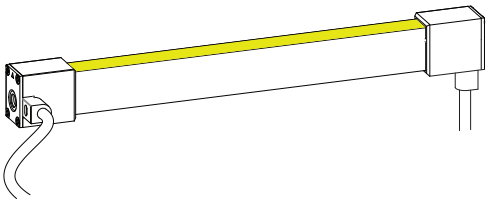
TRCE-V-LEAD-S-F
Left Facing Side Lead with 5′ Power Cable to
Right Facing Front Lead with 5′ Power Cable



TRCE-V-LEAD-F-S
Left Facing Front Lead with 5′ Power Cable to
Right Facing Side Lead with 5′ Power Cable

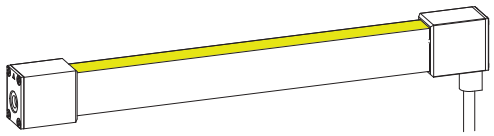


TRCE-V-LEAD-B-S
Left Facing Bottom Lead with 5′ Power Cable to
Right Facing Side Lead with 5′ Power Cable

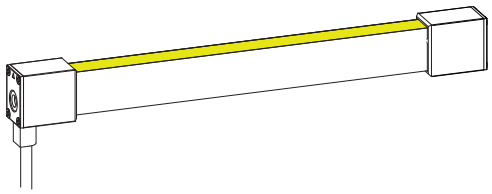


TRCE-V-LEAD-S-B
Left Facing Side Lead with 5′ Power Cable to
Right Facing Bottom Lead with 5′ Power Cable

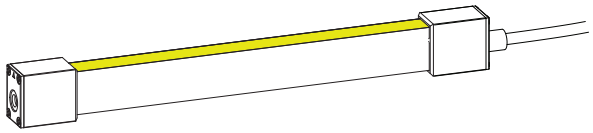
Power Lead Configurations



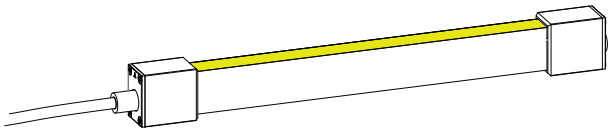
TRCE-V-LEAD-E-B
Left End Cap Lead to Right Facing Bottom Lead with 5′ Power Cable



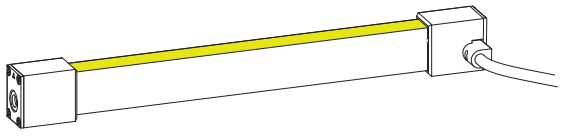
TRCE-V-LEAD-B-E
Left Facing Bottom Lead with 5′ Power Cable to Right End Cap



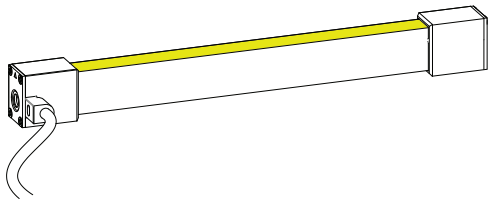
TRCE-V-LEAD-E-F
Left End Cap Lead to Right Facing Front Lead with 5′ Power Cable



TRCE-V-LEAD-F-E
Left Facing Front Lead with 5′ Power Cable to Right End Cap



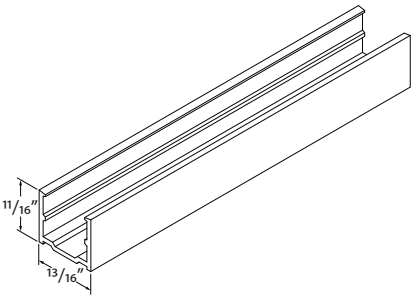
TRCE-V-LEAD-E-S
Left Facing End Cap Lead to Right Facing Side Lead with 5′ Power Cable

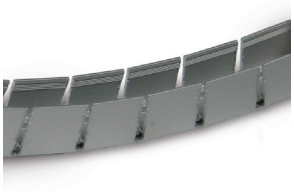


TRCE-V-LEAD-S-E
Left Facing Side Lead with 5′ Power Cable to Right Facing End Cap

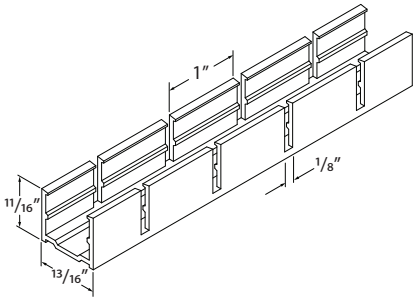
Mounting Options

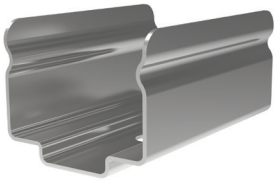
TRCE-V-SLV-SCHAN-6.5
Straight Channel
Vertical Profile Only
6.56' Length, Aluminum



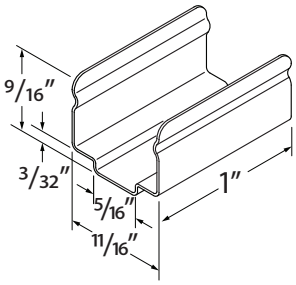


TRCE-V-SLV-NCHAN-6.5
Notched Channel
Vertical Profile Only
Radius Bend: 11"
6.56' Length, Aluminum





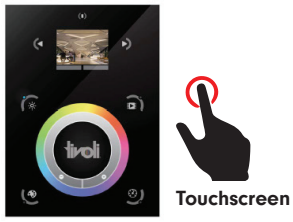
TRCE-V-SLS-MTCLIPS
Mounting Clips
Vertical Profile Only
2 Stainless Steel Clips with 2 Screws



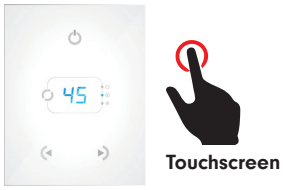
FLXD-SIL-GE-10
GE Silicone 10oz Tube
Use to adhere TRACE into entire run length of channel
25' estimated bead length per 10oz tube

Controls & Software

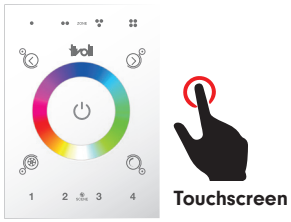
CONTROLS



TVOQ-10-XX-7
XX = BK (black), WH (white)
1024 DMX channel, 500 scene,
10 zone, glass touch screen



TVOQ-2-XX
XX = BK (black), WH (white)
512 DMX channel, 99 scene,
1 zone, glass touch screen



TVOQ-1-WHT
512 DMX channel, 16 scene,
4 zone, glass touch screen

SOFTWARE

Cue™ and CuePro™ softwares are specifically designed for the TivoCUE™ in-wall DMX controls and includes an array of tools required by the latest DMX lighting fixtures. Intuitive, with easy-to-use effects that can be dropped into timelines, and multi-zone synchronization capabilities allow you to program a project effortlessly.

www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

Power Supplies - Indoor

ADUL - NON DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-D	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-D				2	2x96W	2x4A
	ADUL-320-3-4-24-D				3	3x96W	3x4A

ADUL - 0-10V DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DOT	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-DOT				2	2x96W	2x4A
	ADUL-320-3-4-24-DOT				3	3x96W	3x4A

ADUL - DMX SINGLE ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DIN	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-DIN				2	2x96W	2x4A
	ADUL-320-3-4-24-DIN				3	3x96W	3x4A

ADUL - DMX MULTI ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-240-2-4-24-DIN-2	Indoor / Damp	100-277V AC 5o/60 Hz	24V DC	2	2x96W	2x4A
	ADUL-320-3-4-24-DIN-3				3	3x96W	3x4A

Power Supplies - Outdoor

ADNM - NON DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-D	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-D				1	96W	4A
	ADNM-240-2-4-24-D				2	2x96W	2x4A
	ADNM-320-3-4-24-D				3	3x96W	3x4A

ADNM - 0-10V DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-DOT	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-DOT				1	96W	4A
	ADNM-240-2-4-24-DOT				2	2x96W	2x4A
	ADNM-320-3-4-24-DOT				3	3x96W	3x4A

ADNM - DMX SINGLE ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-90-1-4-24-DIN	Indoor / Outdoor	100-277V AC 5o/60 Hz	24V DC	1	90W	3.75A
	ADNM-120-1-4-24-DIN				1	96W	4A
	ADNM-240-2-4-24-DIN				2	2x96W	2x4A
	ADNM-320-3-4-24-DIN				3	3x96W	3x4A

ADNM - DMX MULTI ADDRESS

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-240-2-4-24-DIN-2	Indoor / Outdoor	100-277V AC 5o/60 Hz	24V DC	2	2x96W	2x4A
	ADNM-320-3-4-24-DIN-3				3	3x96W	3x4A

ADNM - DMX/DALI FLICKER-FREE FOR TV STUDIO

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADNM Series Class 2 Transformer	ADNM-120-1-4-24-DTV	Indoor / Outdoor	100-277V AC 50/60 HZ	24V DC	1	1x96W	1x4A
	ADNM-240-2-4-24-DTV				2	2x96W	2x4A
	ADNM-320-3-4-24-DTV				3	3x96W	3x4A

Dimmers

DIMMING - 0-10V

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
0-10V Dimmer	DIM-LD-010	Indoor	12V/24V DC	12V/24V DC	30 mA max. output (sink only)

DIMMING - MLV

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
MLV Dimmer	N-600	Indoor	120V AC	120V AC	450W
	N-1000				800W
	N-1500				1200W
	D-600				450W
	M-600				450W
	M-1000				800W

DIMMING - ELV

DESCRIPTION	CAT NO	APPLICATION	INPUT VOLTAGE	OUTPUT VOLTAGE	MAX LOAD
ELV Dimmer	ME-600	Indoor	120V AC	120V AC	450W
	DE-300				300W

ELT-08

Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

Maximum Candela = 52.6 at 90 H 2.5 V

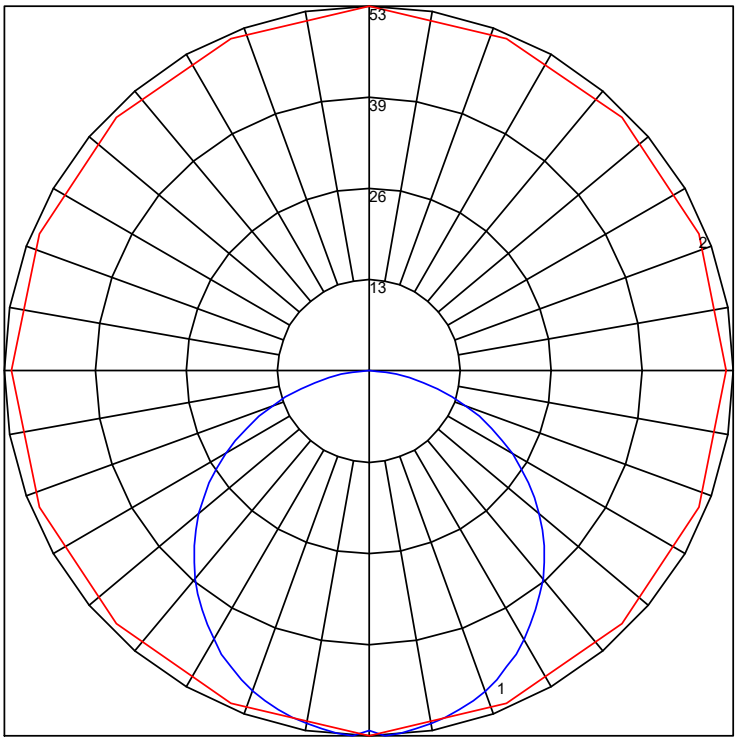
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

Polar Candela Curves:

Vertical Plane Through:
1) 90 - 270 Horizontal

Horizontal Cone Through:
2) 2.5 Vertical



Photometric Report (Type C)

Filename: 4930-TRCESH2724_20(ETL).ies
[TEST] TIVOLI TRCESH2724
[TESTLAB] INTERTEK
[ISSUEDATE] 2/5/2020
[MANUFAC] TIVOLI, LLC

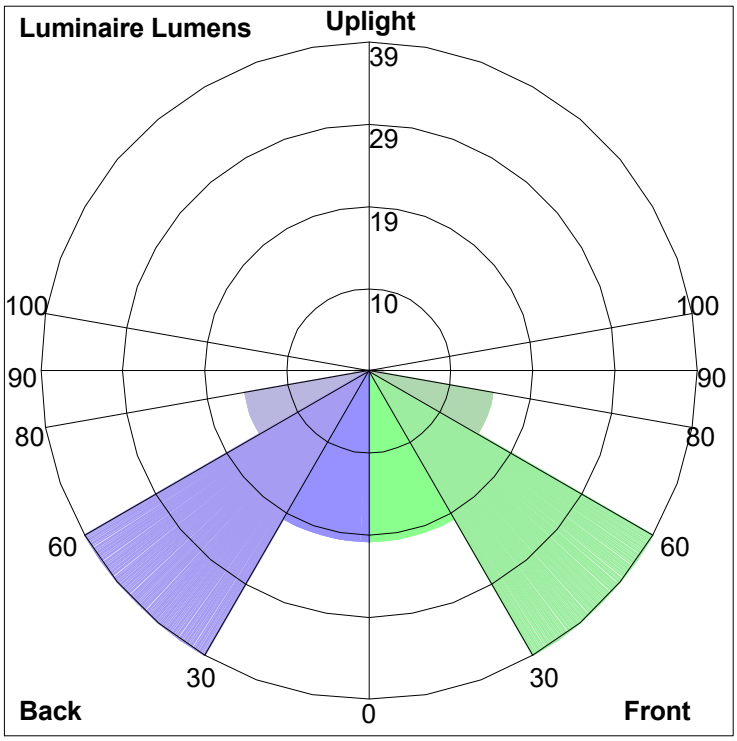
Maximum Candela = 52.6 at 90 H 2.5 V

Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Waste Light Ratio: 0.00
Luminaire Efficacy Rating (LER): 54
Maximum UGR: 26.5
Indoor Classification: Direct
BUG Rating : B0-U0-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	20.1	N.A.	13.3
FM (30-60)	38.8	N.A.	25.7
FH (60-80)	14.9	N.A.	9.9
FVH (80-90)	1.7	N.A.	1.1
BL (0-30)	20.1	N.A.	13.3
BM (30-60)	38.8	N.A.	25.7
BH (60-80)	14.9	N.A.	9.9
BVH (80-90)	1.7	N.A.	1.1
UL (90-100)	0.0	N.A.	0.0
UH (100-180)	0.0	N.A.	0.0
Total	151.0	N.A.	100.0
BUG Rating	B0-U0-G0		



Date: _____ Customer: _____

Project: Compton College -VAPA

Type: ELT-9 Qty: _____

selux

MTR Square Bollard LED

Order Code: BSMFL - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

BSMFL	Series	**BSMFL** MTR Square Bollard LED Flat Top							
_____	Height	**2.5** 2 1/2 feet	**3** 3 feet	**3.5** 3 1/2 feet	**4** 4 feet				
_____	Light Engine	**1B30**	**2B30**	**3B30**	**4B30**				
_____	CCT	**27** 2700K	**30** 3000K	**35** 3500K	**40** 4000K	for other CCTs please consult factory			
_____	Finish	**WH** White	**BK** Black	**BZ** Bronze	**SV** Silver	**SP** Specify Premium Color			
_____	Voltage	**UNV** 120-277V	**120**	**208**	**240**	**277**	**347**[1]	**480**[1]	[1] Requires step down transformer
_____	Options	**DM** Dimming (0-10V)	**HL50**[2] Hi-Lo Switching	**REC** [2,3] GFCI Receptacle w/ weather-proof cover	**REC2** [2,3] GFCI Receptacle w/ padlockable in-use cover				[2] 120V, 240V, and 277V only [3] Only available in 3.5 and 4 ft. heights, 120V only

Product Modifications

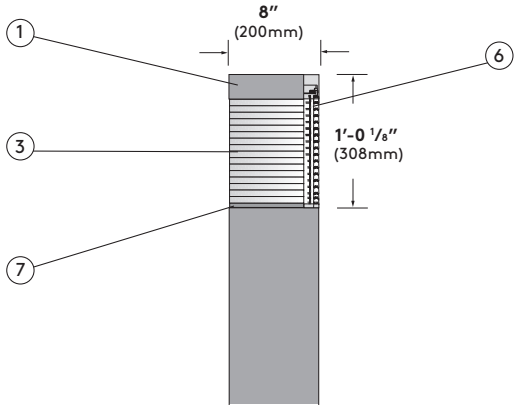
Please list modification requirements for review by factory:

Approvals

Date:

NRTL WET · 5 YEAR LED WARRANTY · UNION MADE IBEW LOCAL 363 · ASTM & PCI FINISH · RoHS COMPLIANT

BSMFL



Net Weight (4' = 40lbs)

Specifications

1. Luminaire Cover - Die-cast, aluminum cover, with smooth crisp form to reflect and complement the bollard design. Removes by loosening four stainless steel screws for easy access to LED chamber.

2. Gasketing - (not shown) Continuous gaskets provide weather-proofing, dust, and insect control at shielding base, fixture cover and between MTR rings.

3. Shielding - Consists of 8" (200mm) square injection-molded acrylic multi-prisms for total reflection (MTR). MTR rings have a wall thickness of .591" and are patterned after the light-bending characteristics of a prism.

4. LED Light Engine - (not shown) High efficiency LED light engine equipped with brand-name LEDs, available in 2700K, 3000K, 3500K, or 4000K CCT tolerance within a 3-step MacAdam ellipse.

5. Drivers - (not shown) Electronic universal 120-277V, PFC > 0.95

6. Diffuser - (not shown) LED optimized UV resistant material ensures evenly lit MTR rings at high transmittance.

7. Bollard Fitter - Die-cast aluminum fitter, with built-in gasketing ridges, for smooth transition to column.

8. Surge Protector - (not shown) Designed to protect luminaire from electrical surge (10kA).

9. Hi-Lo Switching Option - (not shown) Please see p. 3 for details.

Exterior Luminaire Finish - Selux utilizes a high quality Polyester Powder Coating. All Selux luminaires and poles are finished in our Tiger Drylac certified facility and undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultraviolet resistance for color retention. All products are tested in accordance with test specifications for coatings from ASTM and PCI.

Standard exterior colors are White (WH), Black (BK), Bronze (BZ), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the MTR Bollard LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED array when installed and operated according to Selux instructions. For details, see "Selux Terms and Condition of Sale."

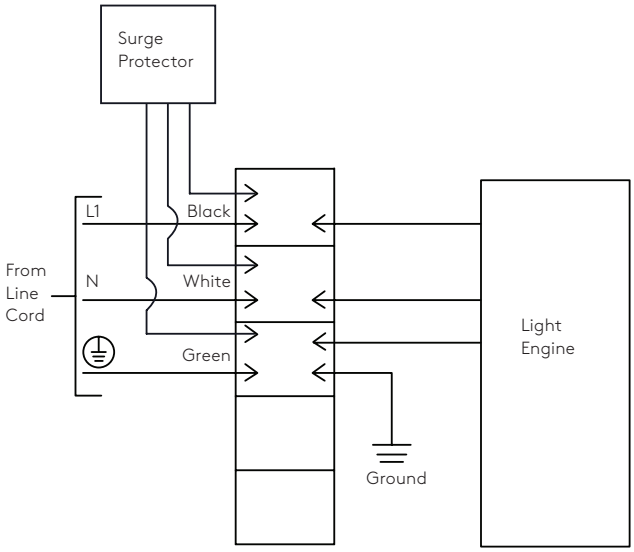
Listings and Ratings: Tested to INRTL Wet Location and IESNA LM-79-08 standards. LED tested to LM-80 standards. Luminaire and LED tested at 25°C (77°F) ambient temperature.

NRTL Listed for Wet Location (i.e. UL, CSA)

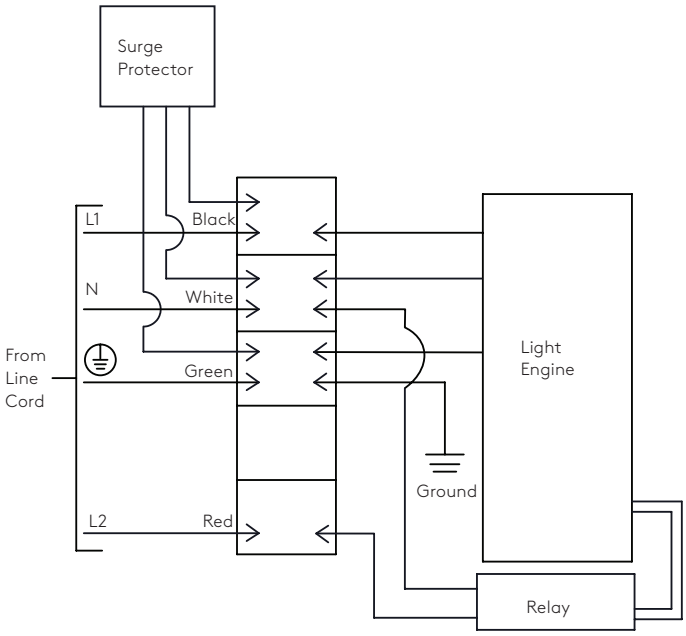
Visit selux.us for our LED End of Life recycling policy.

Wiring

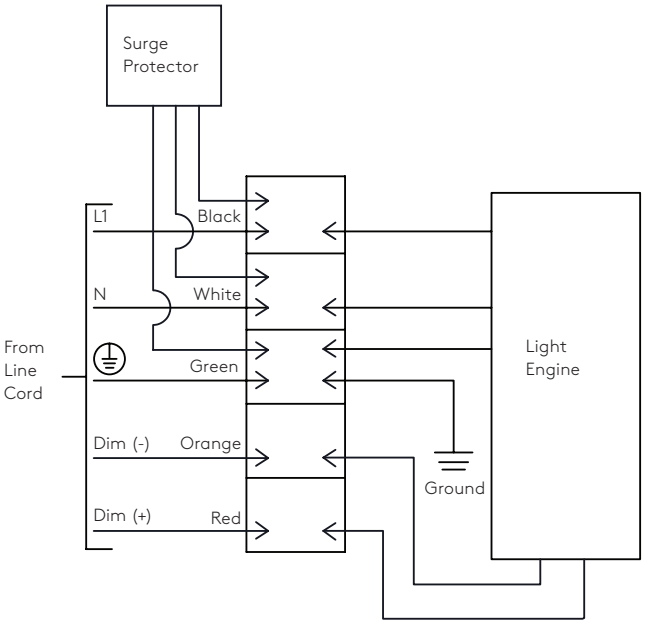
Standard Single Wiring
For 120-277V



Hi-Lo Switching Option (HL) Wiring
For 120-277V. When red is energized, light output will be at "Lo" level. Standard HL level: HL50 = low output, 50%. For other combinations, consult factory.

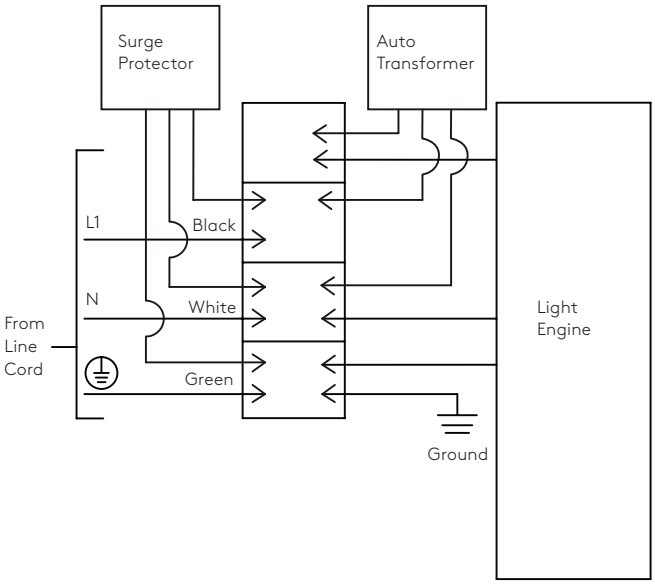


0-10V Dimming Option (DM) Wiring
For 120-277V

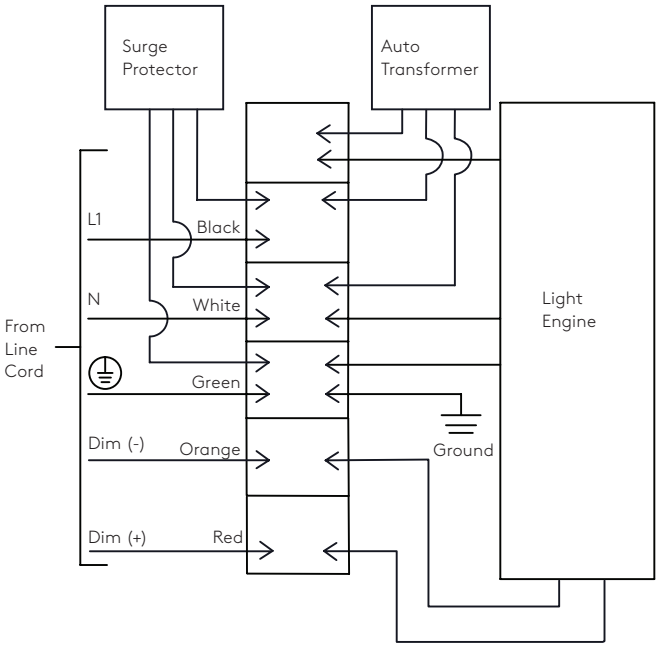


Wiring

347/480V (Standard)

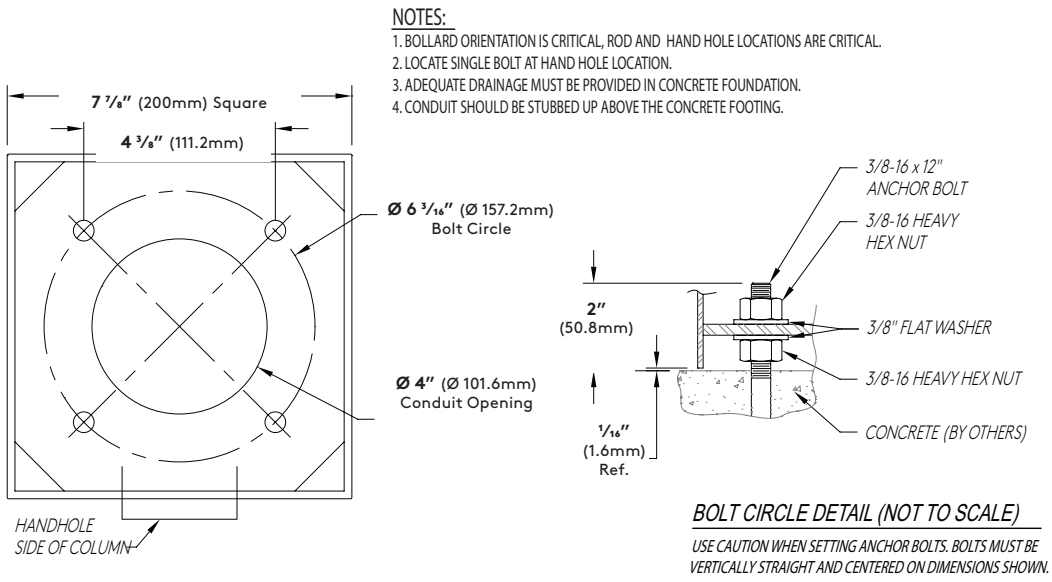


347/480V with 0-10V Dimming Option

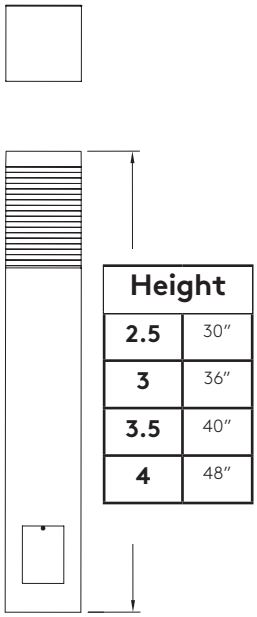


Mounting

Anchorage Information



Profiles

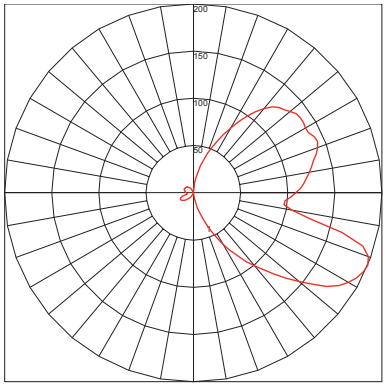


Height	
2.5	30"
3	36"
3.5	40"
4	48"

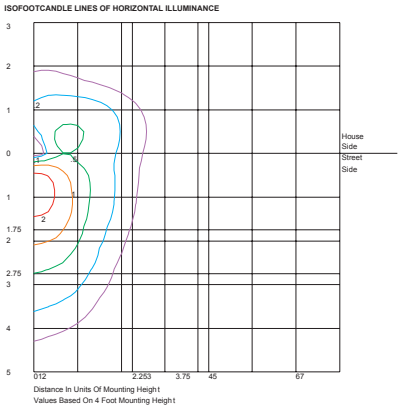
Photometry

1B30 / 7W LED / 3000K CCT

Catalog #: BSMFL-X-1B30-30-XX-UNV
Delivered Lumens: 505
Input Watts: 6.9905W
Efficacy: 72 lm/W
CCT: 2947K
CRI (Ra): 94.9
Maximum candela of 200 at 67.5° from vertical.
IES classification: Type IV
Mounting Height: 4' (1.22m)
BUG Rating: B0-U3-G1
Power Factor: 0.916
Total Harmonic Distortion: 15.4%

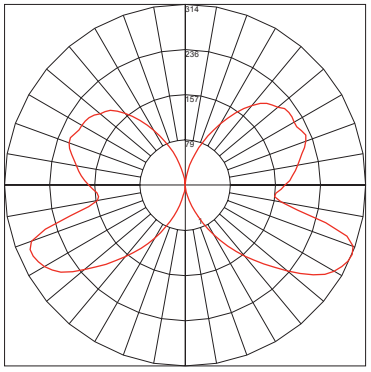


Maximum Candela = 200.175 Located At Horizontal Angle = 0, Vertical Angle = 67.5
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)

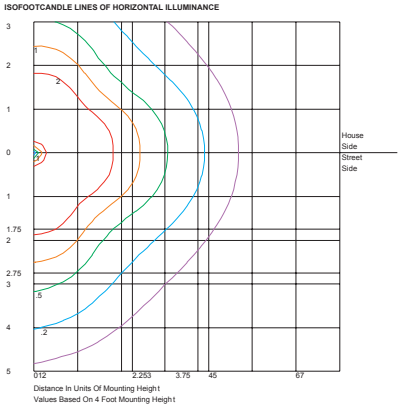


4B30 / 26W LED / 3000K CCT

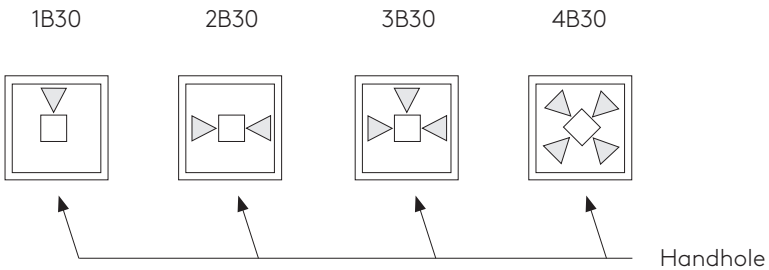
Catalog #: BSMFL-X-4B30-30-XX-UNV
Delivered Lumens: 2207
Input Watts: 26.5947W
Efficacy: 83 lm/W
CCT: 2947K
CRI (Ra): 94.9
Maximum candela of 314 at 67.5° from vertical.
IES classification: Type VS
Mounting Height: 4' (1.22m)
BUG Rating: B1-U4-G1
Power Factor: 0.980
Total Harmonic Distortion: 10.4%



Maximum Candela = 314.4 Located At Horizontal Angle = 0, Vertical Angle = 67.5
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)



LED Light Engine Distribution Guide



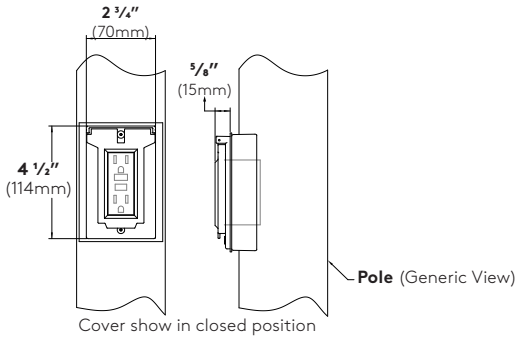
Energy Consumption				
Light Engine	1B30	2B30	3B30	4B30
Power Input	7W	13W	19W	27W

MTR Square LED Bollard Photometry Multiplier Table		
CCT Multiplier		
4000K	1.000	
3500K	1.010	
3000K	0.942	
2700K	0.884	
Light Engine Multiplier		
Light Engine	Lumens	Wattages
1B30	0.243	0.263
2B30	0.459	0.479
3B30	0.680	0.711
4B30	1.000	1.000

Optional Accessories

GFCI Receptacle (REC)

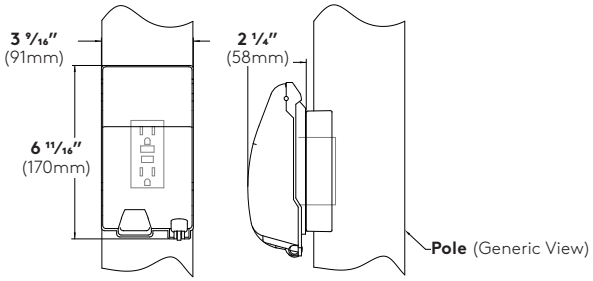
120V 15A GFCI duplex receptacle with weather-proof, self-closing cover; located 18" (457mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel.



Cover show in closed position

GFCI Receptacle (REC2)

120V 15A GFCI duplex receptacle with weather-proof, self-closing, padlockable in-use cover; located 18" (457mm) from base of pole, inline with handhole. Receptacle is intended only for portable tools or other portable equipment to be connected to outlet only when attended by operating personnel.



Cover shown in the closed position

ELT-09

Photometric Report (Type C)

Filename: BSMFL-X-4B30-30-XX-UNV.ies
[TEST] 11751767.07A
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 1/19/2018
[MANUFAC] Selux Corporation
[LUMCAT] BSMFL-X-4B30-40-XX-UNV
[LUMINAIRE] Gray aluminum housing, inner frosted plastic lens, glass l
ens enclosure
[LAMP] 140 white LEDs
[BALLAST] One eldoLED ECOdrive 361/S

Maximum Candela = 314.4 at 0 H 67.5 V

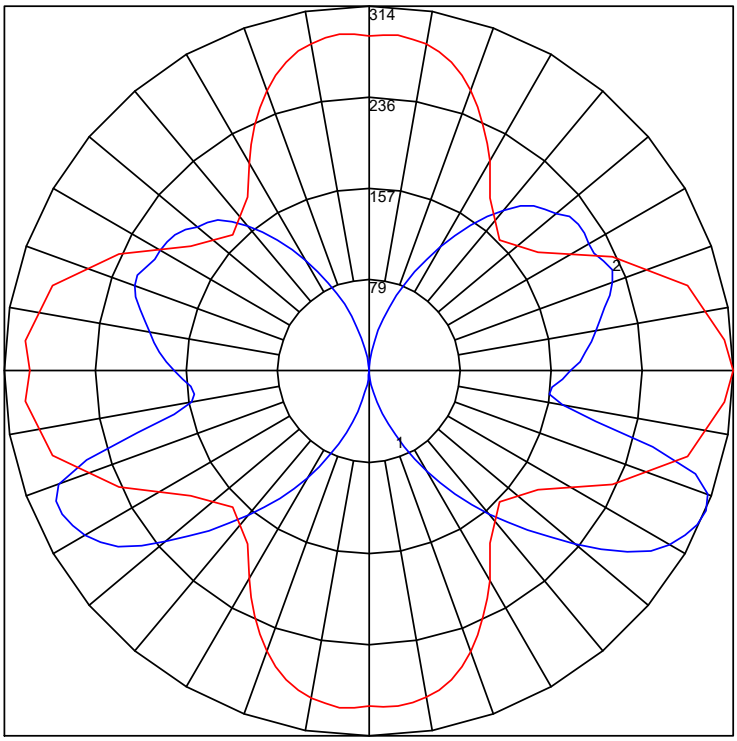
Classification:

Road Classification: Type VS, Very Short, N.A. (deprecated)
Upward Wast Light Ratio: 0.50
Luminaire Efficacy Rating (LER): 83
Maximum UGR: 23.5
Indoor Classification: General Diffuse
BUG Rating : B1-U4-G1

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 67.5 Vertical



Photometric Report (Type C)

Filename: BSMFL-X-4B30-30-XX-UNV.ies
[TEST] 11751767.07A
[TESTLAB] UL Verification Services Inc.
[ISSUEDATE] 1/19/2018
[MANUFAC] Selux Corporation
[LUMCAT] BSMFL-X-4B30-40-XX-UNV
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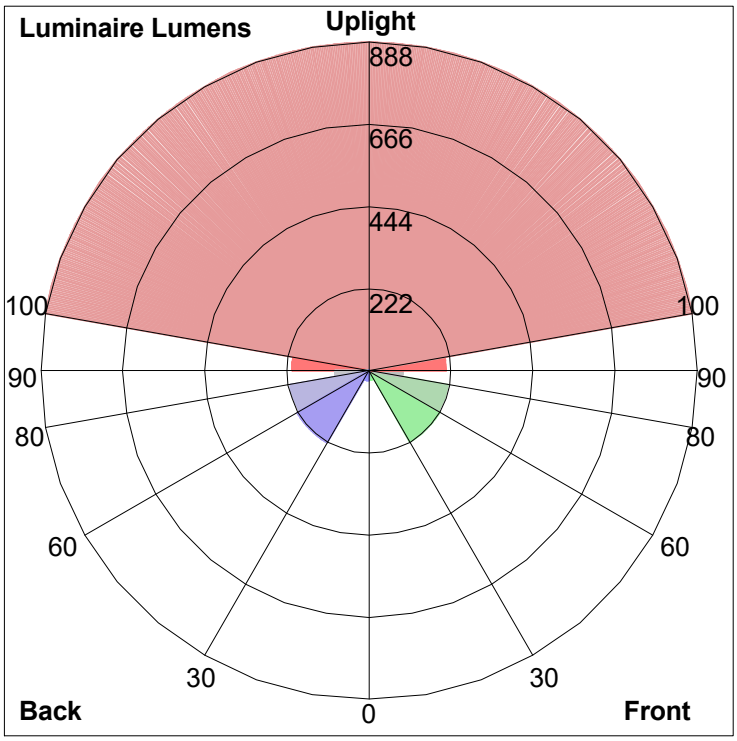
Upward Waste Light Ratio: 0.50
Luminaire Efficacy Rating (LER): 83
Maximum UGR: 23.5
Indoor Classification: General Diffuse
BUG Rating : B1-U4-G1

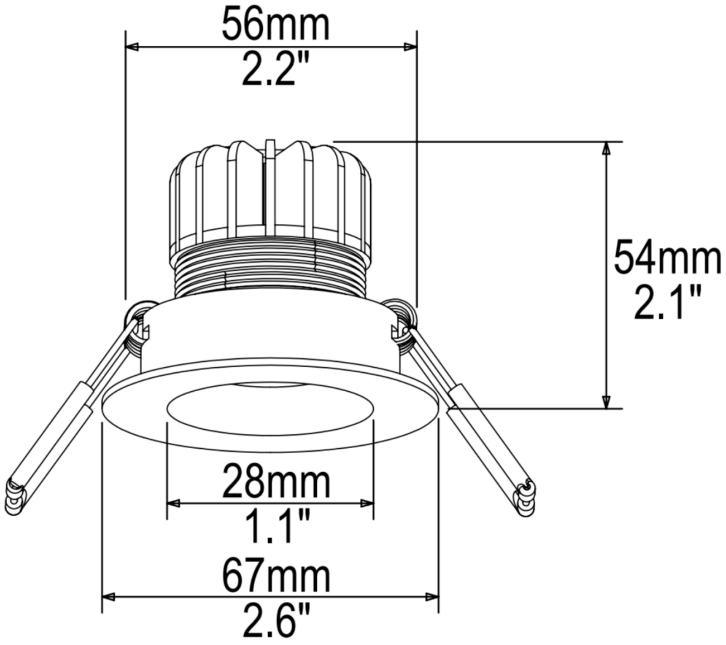
LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	24.0	N.A.	1.1
FM (30-60)	221.3	N.A.	10.0
FH (60-80)	216.4	N.A.	9.8
FVH (80-90)	90.5	N.A.	4.1
BL (0-30)	25.3	N.A.	1.1
BM (30-60)	224.3	N.A.	10.2
BH (60-80)	216.7	N.A.	9.8
BVH (80-90)	91.6	N.A.	4.1
UL (90-100)	208.1	N.A.	9.4
UH (100-180)	888.3	N.A.	40.3
Total	2206.5	N.A.	100.0
BUG Rating	B1-U4-G1		



ZANIBONI® LIGHTING

Project	Compton College -VAPA
Type	ELT-10
Contact	



LUNA 1 S

1 Light Sources

1" | 893 lm / per light source
Round | Fixed | Downlight

Performance Options	3W	7W	9W
Source Lumens	lm	lm	1188 lm
Delivered Lumens	370 lm	617 lm	893 lm
Lumens / Watt	123 lm	88 lm	99 lm
Current	mA	mA	250 mA

CRI/CCT Multiplier	2700°K	3000°K	3500°K	4000°K
80 CRI	0.93	1.00	1.00	1.07
95 CRI	0.69	0.75	0.81	0.87

D1	LUN1S	___	___	___	___	___	___	___	___	___
Source	Model	Wattage	Kelvin	CRI	Beam	Lens	Color	Driver	Installation	I.P. Rating
D1	LUN1S:Luna 1 S	03:03W 07:07W 09:09W(9 watt option adds 1 inch to fixture height)	27:2700k 30:3000k 35:3500k 40:4000k WD:Warm Dim 1800K to 3000K (Not Avail. for 18w) RW:RGBW TD:Tunable White 2700K to 6500K (Daylight Range 2700K to 6500K) TH:Tunable White 1800K to 4000K (Hospitality Range 1800K to 4000K)	A:80 B:95	1:10° 2:24° 3:36° 6:60°	F:Frosted X:Hex Louver + Solite L:Cross Louver + Solite P:Prismatic S:Solite C:Clear	SS:Marine Grade Stainless Steel WS:Matte White BK:Matte Black C:Custom Color	0:No Driver N:Non-Dimmable E:ELV Dimmable Z:0-10V Dimmable to 1% B:Bluetooth T:Lutron™ (Phase Dimming) L:Lutron™ (Lutron EcoSystem / Contact sales for price) D:DALI(Only for - option) X:DMX V:Constant Voltage Dimmable(Transformer must be remote)	00:No Accessories (Option when product is installed in Low Voltage - Class 2) D0:Class 2, Non-IC ** E0:Airtight Enclosure F0:Chicago Plenum G0:Title 24 for Residential R0:Retro-Fit Enclosure RL:Retro-Fit for Lutron™ ** A0:Class 1, IC B0:Class 1, Non-IC	W:Wet IP 65(in case of outdoor application without air conditioning, use 9-watt heat sink option but run at 3-watt power in order to increase heat dissipation)

Optional Emergency Backup Battery can be found on Products/Accessories

Generated on **06-01-2022**

** only if access from above ceiling is available

Zaniboni lighting - Ph +1(727)213-0410 - Fx +1(727)683 - 9720 - zanibonilighting.com - 101 N Garden Ave Suite 230, Clearwater - FL 33755

Specifications

This specification Grade LED downlight offers a wide selection of LED modules options to address design requirements in the spaces it illuminates. Many additional custom options are available; please contact manufacturer for details.

LED source
Tool-free field-replaced LED module. Propriety high performance aluminum die cast heatsink for maximum LED life.

Source
Computer-optimized reflector design. High reflected finish aluminum. Tool-free field-interchangeable reflectors and lens. 0-20°(O version), 0-40°(J version) vertical and 360° horizontal adjustment.

Body
Die-cast aluminum frame and body.

Trim
Die-cast aluminum CNC machine finished Minimal thickness. White can be field painted to match adjacent finishes.

Fixture retention
Two torsion springs hold the fixture tight to the ceiling accommodating ceiling thickness from 1/16" to 1". Special springs for thicker ceiling available on request.

Life
Rated for 50,000 hours at 70% lumen maintenance.

Label
ETL listed for US Canada. CE labeled. CCC label available on request.

Warranty
5 years limited warranty.

Wet location(if option is available ont and selected on page 1)
Sealed lens and integral silicon gasket behind the trim.

Dimming compatibility

Zaniboni fixture are compatible with all major dimming protocol in the industry. Please refer to zanibonilighting.com for general compatibility and wiring diagrams. Zaniboni recommends testing your unique dimming configuration as the exact full configuration (Dimmer, drivers, fixture quantities, voltage) may affect dimming performance.

N: Non-Dimmable

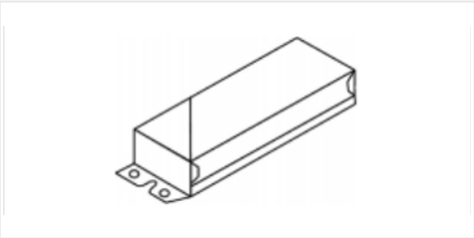
110-277V, 50/60Hz.

Economic solution for ON-OFF applications not requiring dimming.

E: ELV Dimmable

110-277V, 50/60Hz.

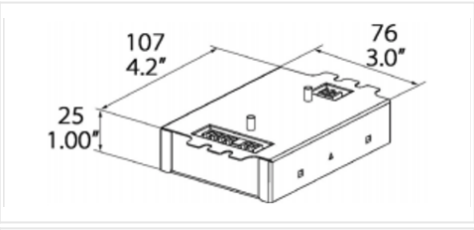
For ELV(Electronic Low Voltage) dimmers. Best for new construction application. Dims down to less than 10% light output(most cases). Consult dimming manufacturer for installation instructions. Must meet dimmer Minimum load Requirements.



Z: 0-10V Dimmable

110-277, 50/60Hz.

Prevalent solution on commercial projects. Integrates into a variety of building management and day lighting controls. Dims down to less than 1% light output(most cases). Must meet dimmer Minimum Load Requirements. Consult dimming manufacturer for installation instructions.

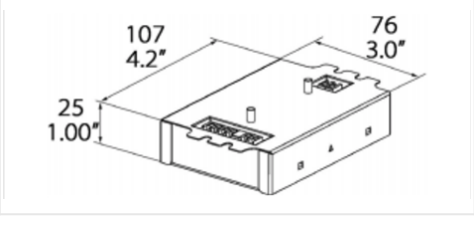


L: Lutron Hi-Lume A LDE

120-277V, 50/60Hz.

For LUTRON EcoSystem drivers only. Continuous dimming to 1%

Consult dimming manufacturer for installation instructions. Requires access from above on all fixtures with a cutout below 81mm.



T: Lutron Hi-Lume A LTE

120V, 50/60Hz.

For 2-wire Forward Phase Controls. Continuous dimming to 1%

Consult dimming manufacturer for installation instructions. Requires access from above on all fixtures with a cutout below 81mm.

N&E: Non-Dimmable & ELV Drivers

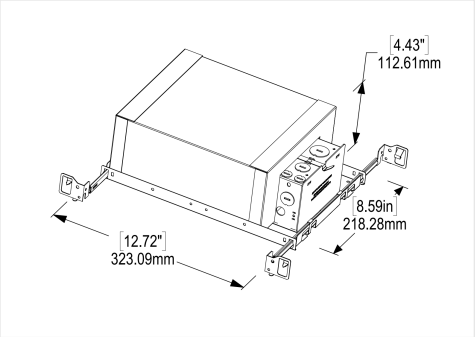
Measurements	LWH in mm	LWH in inches
7W - 9W - 13W	85.5 - 38 - 27.7	3.36" - 1.49" - 1.09"
18W - 26W	89 - 41 - 31.5	3.5" - 1.62" - 1.24"
36W - 50W	89 - 41 - 31.5	3.5" - 1.62" - 1.24"

N&E: Non-Dimmable, ELV Drivers & 0-10V Dimmable

Measurements	LWH in mm	LWH in inches
7W - 9W - 13W	85.3 - 38 - 27.7	3.36" - 1.49" - 1.09"
18W - 26W	89 - 41 - 31.5	3.5" - 1.62" - 1.24"
36W - 50W	138 - 47 - 32	5.43" - 1.85" - 1.25"

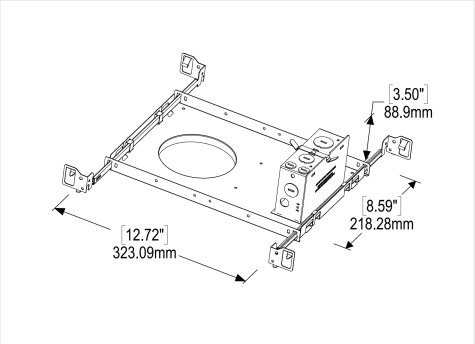
Zaniboni lighting - Ph +1(727)213-0410 - Fx +1(727)683 - 9720 - zanibonilighting.com - 101 N Garden Ave Suite 230, Clearwater - FL 33755

Enclosures



A: Class 1, IC

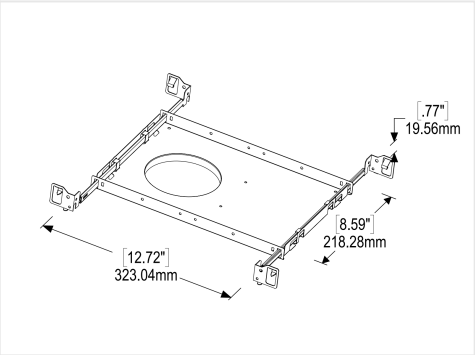
For installation in ceilings with insulation. Driver "on board".



B: Class 1, Non-IC

For installation in ceilings with no insulation or spray foam. Driver "on board".

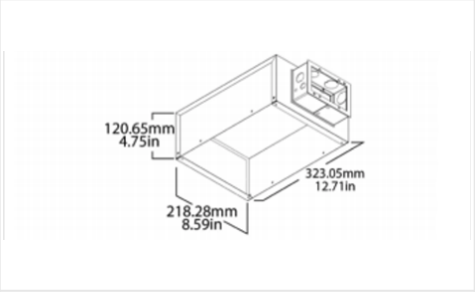
National or municipal codes must be followed regarding set back of thermal insulating material from fixture. Fixture are not designed for direct contact with thermal insulation.



D: Class 2, Non-IC

For installation on ceiling without insulation

National or municipal codes must be followed regarding set back of thermal insulating material from fixture. Fixture are not designed for direct contact with thermal insulation.



E: Airtight Enclosure

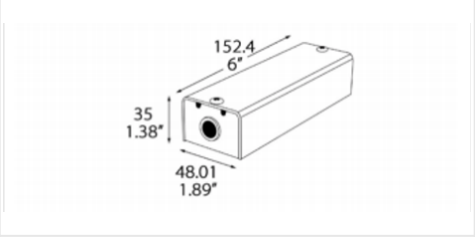
For installation were AT(Air-Tight) standards is required.

F: Chicago Plenum

Enclosure complies with Chicago Plenum requirements.

G: Title 24 for Residential

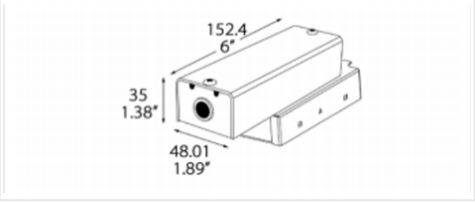
Enclosure complies with California Title 24 requirements for specific residential applications. Please consult with your local inspector



R: Retro Fit-Enclosure

Available in assorted cutout sizes for easy installation of light fixture. For installation in plaster or t-bar ceilings.

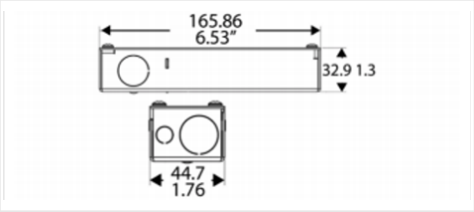
National or municipal codes must be followed regarding set back of thermal insulating material from fixture. Fixture are not designed for direct contact with thermal insulation.



RL: Retro Fit-Enclosure Coupled With Lutron HI-Lume Driver

When the Retro-Fit Enclosures is paired with any Lutron Driver, the Lutron Driver will be mounted atop the Retro-Fit enclosure with the line voltage connection inside the junction box. Requires access from above on all fixtures with a cutout below 104mm.

Zaniboni lighting - Ph +1(727)213-0410 - Fx +1(727)683 - 9720 - zanibonilighting.com - 101 N Garden Ave Suite 230, Clearwater - FL 33755



RM: Retro-Fit Mini

Used with our 1" aperture Lunas&Albas.

National or municipal codes must be followed regarding set back of thermal insulating material from fixture. Fixture are not designed for direct contact with thermal insulation.

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IES ROAD REPORT
PHOTOMETRIC FILENAME : D1-LUNA1-07-30-A-6-F-1.IES

DESCRIPTIVE INFORMATION (From Photometric File)

IESNA: LM-63-2002
[TEST] 05-21-18-14
[TESTLAB]
[ISSUEDATE] 21-May-18
[MANUFAC] Zaniboni Lighting
[LUMCAT] 05-21-18-14
[LUMINAIRE] D1-LUNA1-07-30-A-6-F-1
[LAMP] D1-LUNA1-07-30-A-6-F-1

CHARACTERISTICS

IES Classification	Type I
Longitudinal Classification	Very Short
Lumens Per Lamp	784 (1 lamp)
Total Lamp Lumens	784
Luminaire Lumens	533
Downward Total Efficiency	68 %
Total Luminaire Efficiency	68 %
Luminaire Efficacy Rating (LER)	76
Total Luminaire Watts	7
Ballast Factor	1.00
Maximum Candela	411.52
Maximum Candela Angle	360H 0V
Maximum Candela (<90 Degrees Vertical)	411.52
Maximum Candela Angle (<90 Degrees Vertical)	360H 0V
Maximum Candela At 90 Degrees Vertical	.86 (0.1% Lamp Lumens)
Maximum Candela from 80 to <90 Degrees Vertical	4.55 (0.6% Lamp Lumens)
Cutoff Classification (deprecated)	Cutoff

IES ROAD REPORT
PHOTOMETRIC FILENAME : D1-LUNA1-07-30-A-6-F-1.IES

CANDELA TABULATION

Vert. Angles	Horizontal Angles									
	0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
0	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52
10	380.50	379.63	378.83	378.88	379.00	379.50	380.54	381.74	383.34	384.93
20	310.52	309.85	309.32	309.85	310.83	312.37	314.34	316.87	319.68	322.56
30	218.48	218.67	218.85	220.00	221.59	223.85	226.66	229.72	233.17	236.77
40	116.51	117.22	118.93	121.23	124.19	127.99	132.21	136.82	141.27	145.99
50	48.63	49.08	49.89	51.08	52.34	54.11	55.85	58.19	60.55	62.96
60	20.25	20.84	21.23	21.97	22.71	23.58	24.55	25.69	26.78	27.83
70	6.20	6.32	6.63	6.99	7.65	8.39	9.02	9.95	10.66	11.17
80	1.50	1.65	1.79	1.90	2.01	2.44	2.73	2.80	2.94	3.22
90	0.13	0.08	0.08	0.16	0.13	0.13	0.29	0.29	0.29	0.25

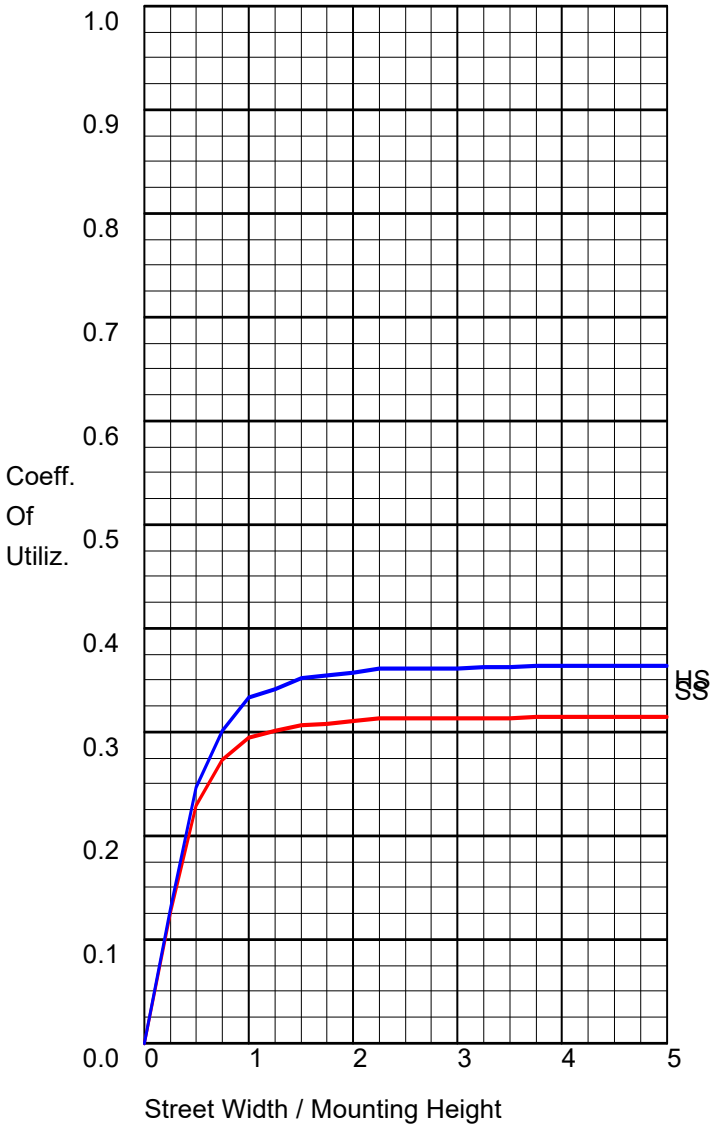
Vert. Angles	Horizontal Angles									
	100	**110**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**
0	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52
10	386.68	388.35	390.34	392.01	393.74	395.01	395.76	396.84	397.39	397.87
20	325.95	329.17	332.42	335.30	338.00	339.82	341.37	342.38	342.93	343.06
30	240.37	243.99	247.55	251.35	254.03	256.41	258.31	259.28	259.59	259.28
40	150.54	154.63	158.34	161.72	164.24	166.28	167.99	168.84	169.22	168.51
50	65.62	68.02	70.51	72.63	74.38	75.99	76.83	77.28	77.34	76.44
60	28.93	29.95	31.08	31.98	32.72	33.35	33.62	33.62	33.30	32.68
70	11.95	12.50	13.12	13.39	13.70	13.82	13.90	13.82	13.51	13.20
80	3.51	3.80	4.15	4.20	4.37	4.55	4.48	4.40	4.30	4.20
90	0.45	0.29	0.49	0.70	0.86	0.78	0.78	0.86	0.70	0.49

Vert. Angles	Horizontal Angles									
	200	**210**	**220**	**230**	**240**	**250**	**260**	**270**	**280**	**290**
0	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52	411.52
10	397.70	397.31	396.44	395.60	394.28	392.93	391.17	389.54	387.78	385.79
20	342.41	341.34	339.48	337.30	334.81	332.16	329.52	326.69	323.88	321.02
30	258.14	256.59	254.25	251.41	248.19	244.74	241.37	237.78	233.92	230.16
40	166.98	165.09	162.05	158.38	153.84	149.09	144.24	139.03	133.88	129.16
50	74.88	72.88	70.77	68.10	65.32	62.50	59.77	57.37	54.92	52.88
60	31.82	30.85	29.48	28.35	27.02	25.72	24.55	23.54	22.40	21.54
70	12.80	12.38	11.67	10.85	10.27	9.65	8.90	8.35	7.54	6.91
80	4.09	3.94	3.66	3.37	3.01	2.87	2.58	2.30	2.16	1.90
90	0.29	0.41	0.25	0.13	0.29	0.29	0.29	0.29	0.29	0.29

Vert. Angles	Horizontal Angles						
	300	**310**	**320**	**330**	**340**	**350**	**360**
0	411.52	411.52	411.52	411.52	411.52	411.52	411.52
10	383.92	381.89	379.93	378.38	376.75	375.43	380.50
20	318.47	315.63	312.89	310.69	308.21	306.57	310.52
30	226.80	223.65	220.93	218.73	216.84	215.56	218.48
40	125.34	122.01	118.85	116.66	115.25	114.65	116.51
50	51.11	49.82	48.83	48.06	47.64	47.69	48.63
60	20.92	20.33	19.90	19.59	19.59	19.71	20.25
70	6.52	6.29	5.94	5.90	5.98	5.98	6.20
80	1.54	1.58	1.41	1.47	1.32	1.47	1.50
90	0.13	0.13	0.13	0.13	0.16	0.16	0.13

IES ROAD REPORT
PHOTOMETRIC FILENAME : D1-LUNA1-07-30-A-6-F-1.IES

COEFFICIENTS OF UTILIZATION



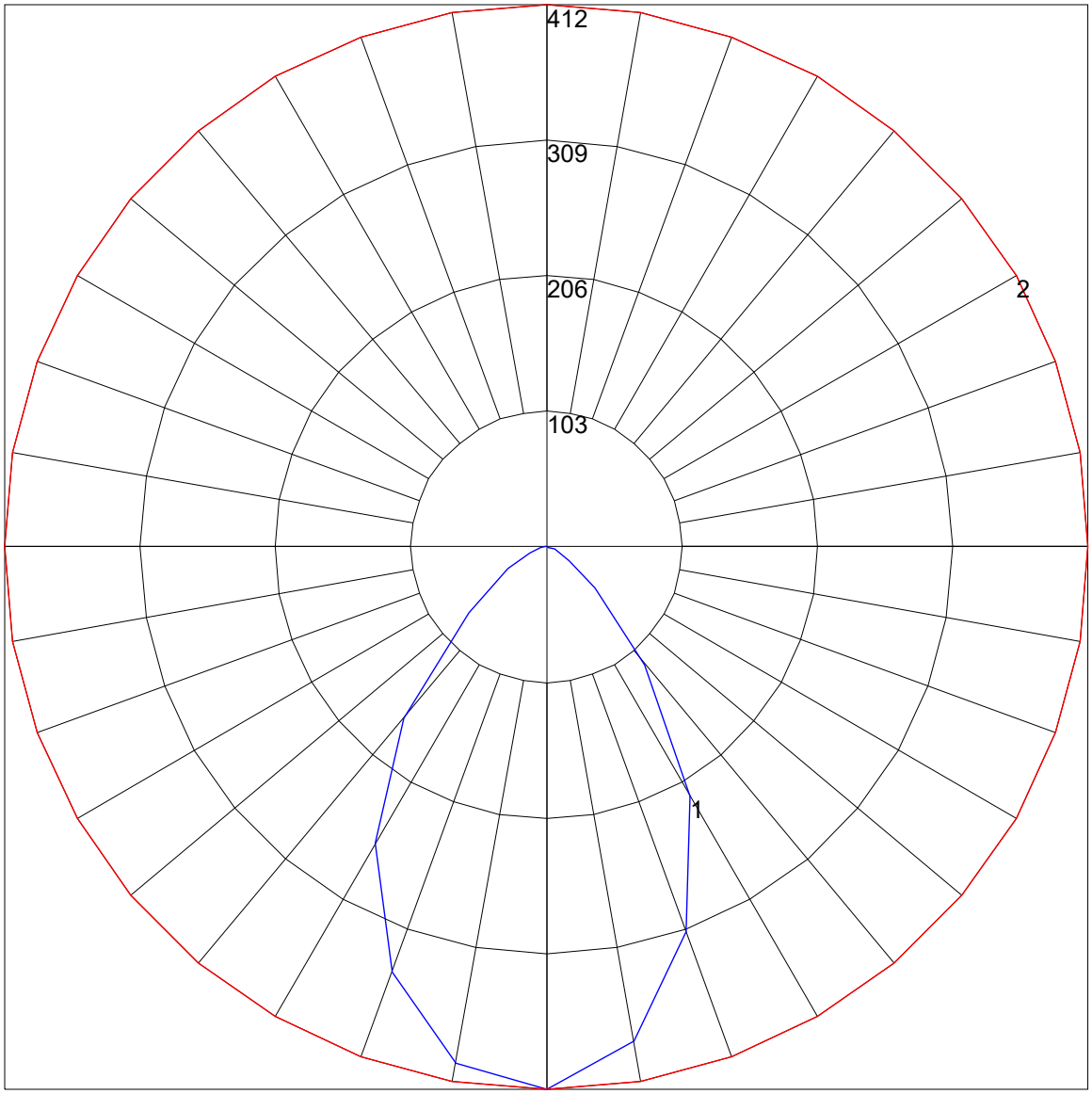
FLUX DISTRIBUTION

	Lumens	Percent Of Lamp
Downward Street Side	246.8	31.5
Downward House Side	286.5	36.5
Downward Total	533.3	68.0
Upward Street Side	0.0	0.0
Upward House Side	0.0	0.0
Upward Total	0.0	0.0
Total Flux	533.3	68.0

ELT-10

IES ROAD REPORT
PHOTOMETRIC FILENAME : D1-LUNA1-07-30-A-6-F-1.IES

POLAR GRAPH

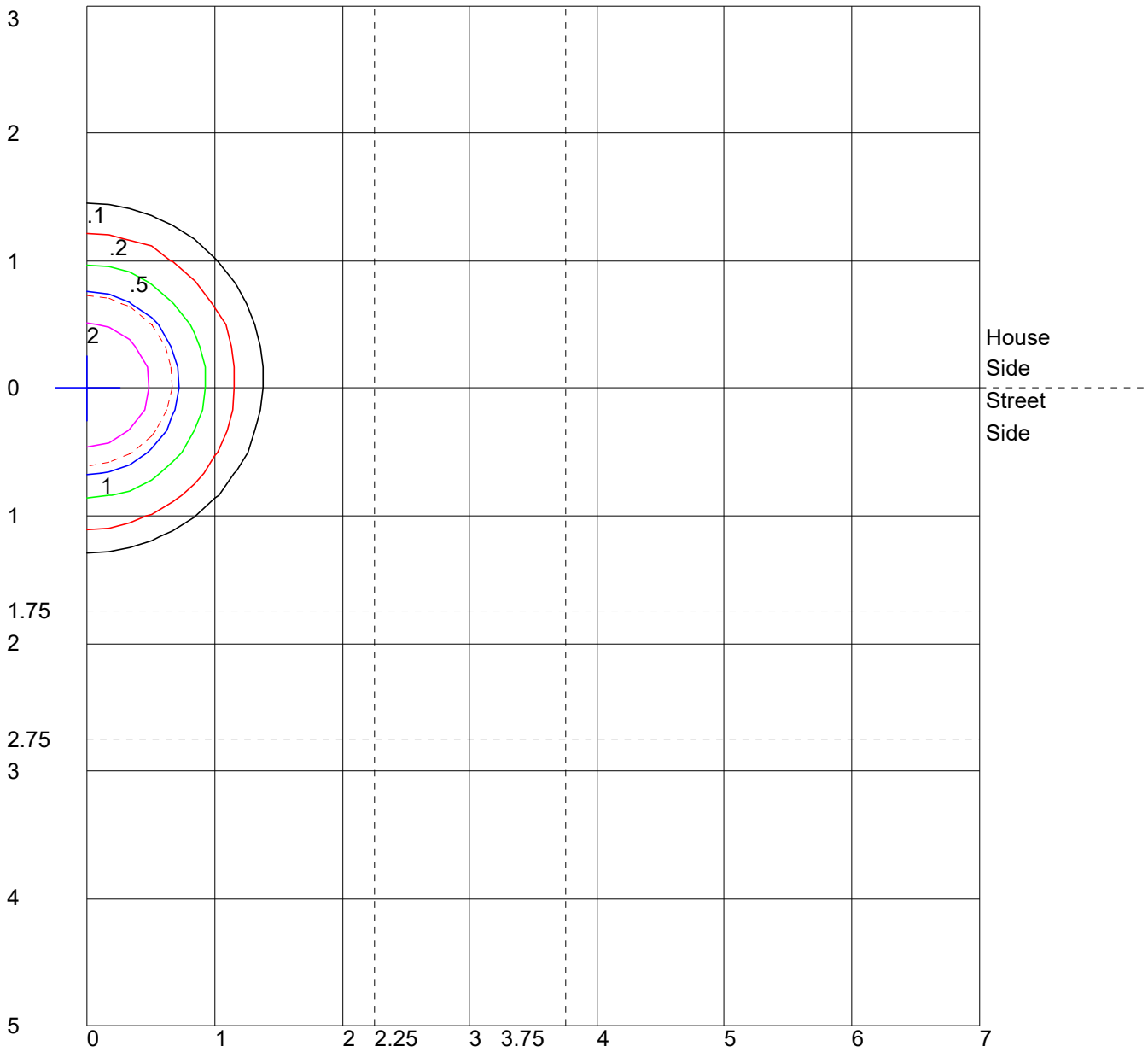


Maximum Candela = 411.52 Located At Horizontal Angle = 360, Vertical Angle = 0
1 - Vertical Plane Through Horizontal Angles (360 - 180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

ELT-10

IES ROAD REPORT
PHOTOMETRIC FILENAME : D1-LUNA1-07-30-A-6-F-1.IES

ISOFOOTCANDLE LINES OF HORIZONTAL ILLUMINANCE



Distance In Units Of Mounting Height
Values Based On 10 Foot Mounting Height
1/2 Maximum Candela Trace Shown As Dashed Curve
(+) = Maximum Candela Point

Received
By PCM3 at 12:54 pm, April 27, 2023

ALUSF
Surface Mount LED Profile

JOB NAME: Compton College -VAPA
LOCATION:
QUOTE/REF#: ELT-11 housing

The **ALU-SF** is an architectural-grade LED extrusion designed for linear LED strips up to 12mm (0.48”) wide. Made from high quality aluminum, these extrusions provide superior thermal management for LED strips and prolong the lighting system’s lifespan. Manufactured with a patented frosted diffuser for maximum lumen output and wider beam distribution.

SPECIFICATIONS

TYPE	Surface mount
AVAILABLE LENGTHS	$39^{3/8}$”, $78^{7/8}$” and 98”
FINISH	Anodized Silver / Black
LENS OPTIONS	Frosted / Clear
CHANNEL	ALU-SF
LENS (SOLD SEPARATELY)	ALU-LN50-FR (frosted)
	ALU-LN50-CL (clear)
END CAP	ALU-SF-EC
MOUNTING CLIPS	ALU-SC-M

Compatible with LED strips up to 12mm (0.48”) wide.

LED tape light sold separately.

Clear and Frosted Lens diffuser sold separately

2 (two) end caps included with every channel.

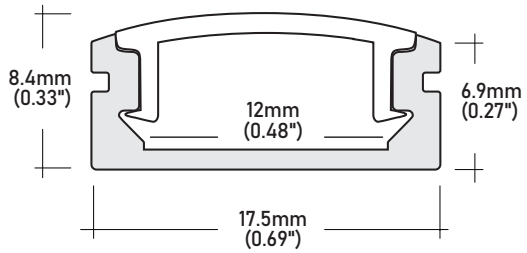
Custom color finishes available (powder-coating).

98” profile NOT available in black

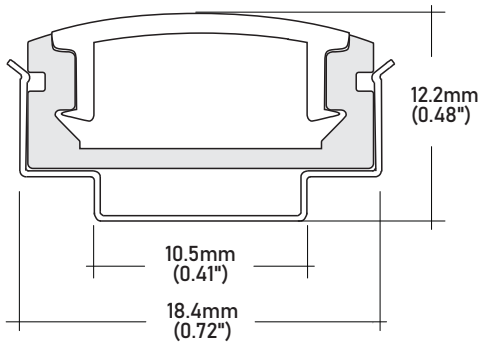
FEATURES

- Customizable
- Durable, anodized aluminum
- Protects LED systems from dust and other elements
- Slim, low profile design
- Dissipates heat from LED, prolonging its lifetime

DIMENSIONS



DIMENSIONS with mounting clip



150 West Carob Street, Compton, California 90220
info@corelightingusa.com | www.corelightingusa.com
T: 888.737.9192 | F: 888.789.4643

ALUSF
Surface Mount LED Profile

CORE ARCHITECTURAL LIGHTING

STANDARD ORDERING CODE (CHANNEL)

Model	Length	Finish
ALUSF	**39** 39.375"	**SI** Silver
	78 78.875"	**BK** Black (39" & 78" ONLY)
	98 98"	**CU** Custom (powder-coat)

STANDARD ORDERING CODE (LENS)

Model	Length
ALULN50	**39** 39.375"
	78 78.875"
	98 98"

NOTE: Custom color finishes require powder coating. Allow 7 days lead time.

98" profile NOT available in black

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ALUSF
Surface Mount LED Profile

ALU-LN50 | Plastic Lens (sold separately)

TYPE FR (frosted) | CL (clear)
LENGTHS 39 3/8", 78 7/8" and 98"

ALU-SF | Aluminum Channel

MOUNTING Surface
LENGTHS 39 3/8", 78 7/8" and 98"

ALU-SF-EC | End Cap

*Two end caps included with every channel

ALU-SC-M | Metal Mounting Clips

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COMPATIBLE LED STRIPS

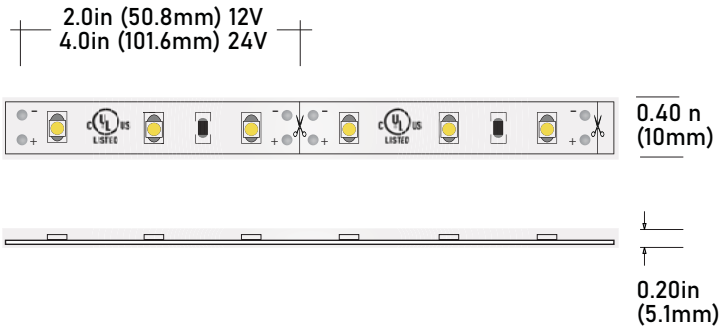
Indoor	Outdoor	Color-changing
LSM-15 1.5W/Ft., 120 Lumens	**LSMW-15** 1.5W/FT, 120 Lumens	**LSP-20-RGB** 2.2W/FT
LSM-25 2.2W/Ft., 185 Lumens	**LSMW-30** 3.0W/FT, 250 Lumens	**LSP-50-RGB** 4.4W/FT
LSM-30 3.0W/Ft., 250 Lumens		**LSP-50-RGB-DX** 4.4W/FT Digital
LSM-32CB 3.2W/Ft., 292 Lumens		**LSP-52-RGBW** 4.4W/FT
LSM-35 3.0W/Ft., 290 Lumens		**LSM-55-RGBW** 5W/FT
LSM-35WD 3.6W/Ft., Auto Warm Dim		**LSP-70-RGBWW** 7W/FT
LSM-40HF 4.0W/Ft., 440 Lumens		
LSM-45 4.4W/Ft., 370 Lumens		
LSP-50 4.4W/Ft., 380 Lumens		
LSM-55 5.5W/Ft., 500+ Lumens		
LSM-55MX 5.5W/Ft., 500+ Lumens		
LSM-55WD 5.5W/Ft., Auto Warm Dim		
LSM-75HF 7W/Ft., 784 Lumens		

Received
By PCM3 at 12:54 pm, April 27, 2023

LSMW15

1.5W Outdoor Flexible LED Strip

JOB NAME: Compton College -VAPA
LOCATION:
QUOTE/REF#: ELT-11 LED Strip



LSMW15 is an outdoor flexible LED strip that delivers 120 lumens at 1.5 Watts per ft. This LED strip is rated to last 50,000 hours making it an excellent replacement for halogen lighting. This product is suitable for use in most residential and commercial applications, it is easy to install. Offered in different CCT options with superior CRI.

SPECIFICATIONS

INPUT VOLTAGE	12V and 24V DC
POWER CONSUMPTION	1.5W per foot
LUMEN OUTPUT	120 Lumens per foot
NO. OF LEDs	18 LEDs per foot
BEAM ANGLE	120°
CRI	95+
DIMMING	MLV, ELV, 0-10 and TRIAC
MAXIMUM RUN LENGTH	16.4 Feet (12V strip)
	24 Feet (24V strip)
FIELD CUTTABLE	Every 2 in (12V)
	Every 4 in (24V)
IP RATING	IP65 wet location (outdoor)
LUMEN MAINTENANCE	50,000 hrs.
OPERATING TEMPERATURE	-40°F(-40°C)~+140°F(+60°C)
BINNING	1.5 Step Macadam Elipse
CERTIFICATIONS	UL listed, TITLE 24 JA8
DIMENSIONS	0.47" x 0.20 (width x height)

FEATURES

- 1.5W / Ft.
- 95+ CRI
- California TITLE 24 JA8 compliant
- Field cuttable
- Suitable for accent or ambient lighting
- Multiple CCT options available
- Available in 12V and 24V
- UL Listed
- Dimmable with CORE Lighting dimmable drivers
- Approved for closet / storage space installation per NEC 410. 16(A)(3) and 410.16(C)(5)

COLOR TEMP	CRI	LUMEN/FT
2200K	94	102
2500K	95	112
2700K	98	115
3000K	98	120
3500K	97	121
4000K	96	124
5000K	95	126
6000K	95	128

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Received
By PCM3 at 12:54 pm, April 27, 2023

LSMW15

1.5W Outdoor Flexible LED Strip

STANDARD ORDERING CODE

Model	Color Temp	Length	Voltage	Profile
LSMW15	**22K** 2200K	**16** 16.4 Ft.	**12** 12 Volts	**[2]See p3 for options**
	24K 2400K	**32** 32 Ft.	**24** 24 Volts	
	27K 2700K	**[1]XX** per Ft.		
	30K 3000K			
	35K 3500K			
	40K 4000K			
	50K 5000K			
	60K 6000K			
	RD Red			
	BL Blue			
	GR Green			
	PK Pink			
	PR Purple			
	AM Amber			
	OR Orange			

NOTE:

1 = Custom length per Ft.
12V strip cuttable every 2”
24V strip cuttable every 4”

2 = Custom color finishes require powder coating. Allow 7 days lead time.

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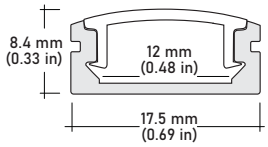
Received
By PCM3 at 12:54 pm, April 27, 2023

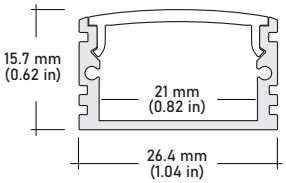
LSMW15
1.5W Outdoor Flexible LED Strip

CORE ARCHITECTURAL LIGHTING

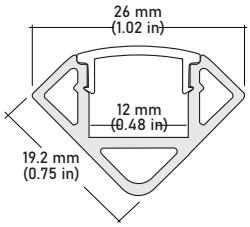
COMPATIBLE ALUMINUM PROFILES



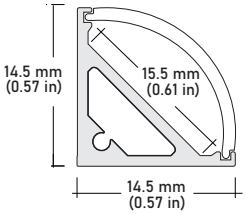
ALU-SF Surface
LENGTHS 39 3/8" | 78 7/8" | 98"
LENS Clear, Frosted
FINISH Silver | Black



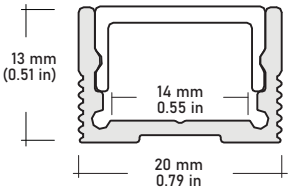
ALU-DS100 Surface Wide
LENGTHS 39 3/8" | 78 7/8" | 96"
LENS Clear, Frosted
FINISH Silver



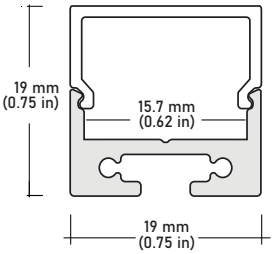
ALU-CN Surface, Corner
LENGTHS 39 3/8" | 78 7/8" | 96"
LENS Clear, Frosted
FINISH Silver | Black



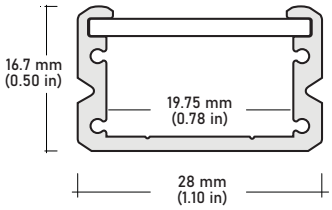
ALP-50C Surface, Corner
LENGTHS 49.25" | 98.5"
LENS Frosted
FINISH White | Black | Silver



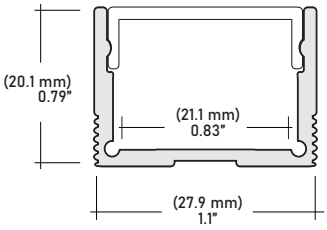
ALP-70 Surface
LENGTHS 49.25" | 98.5"
LENS Frosted
FINISH White | Black | Silver



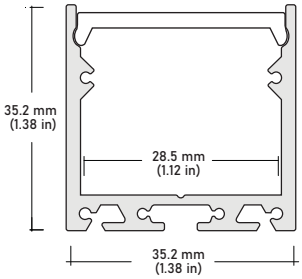
ALP-80 Surface, Suspended
LENGTHS 49.25" | 98.5"
LENS Frosted
FINISH Silver



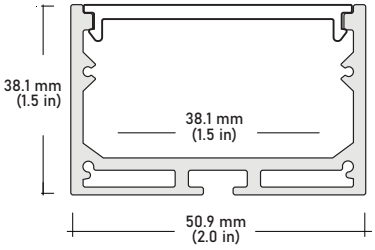
ALP-90 Surface
LENGTHS 48" | 96"
LENS Frosted
FINISH Silver



ALP-130 Surface, Suspended
LENGTHS 49.25" | 98.5"
LENS Frosted
FINISH Silver



ALP-140 Surface, Suspended
LENGTHS 49.25" | 98.5"
LENS Frosted
FINISH Silver

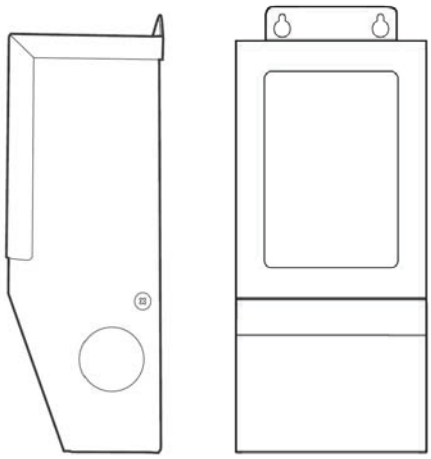


ALP-160 Surface, Suspended
LENGTHS 48" | 98"
LENS Frosted
FINISH Silver

150 West Carob St., Compton, CA 90220
info@corelightingusa.com | www.corelightingusa.com
T: 888.737.9192 | F: 888.789.4643

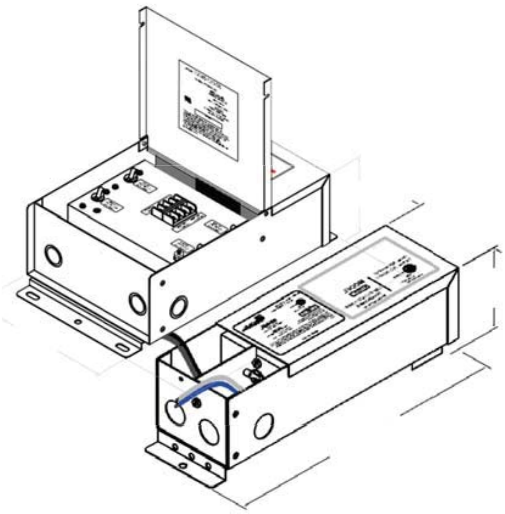
LSMW15
1.5W Outdoor Flexible LED Strip

COMPATIBLE TRANSFORMERS



PSDM 24V SERIES | DIMMABLE MAGNETIC LOW VOLTAGE (MLV)

PSDM-20W-12V	CLASS 2	5.6" x 2" x 2.14"
PSDM-40W-12V	CLASS 2	5.6" x 2" x 2.14"
PSDM-60W-12V	CLASS 2	6.5" x 2.3" x 2.5"
PSDM-100W-12V	CLASS 2	9.8" x 3" x 3"
PSDM-150W-12V		9.8" x 3" x 3"
PSDM-180W-12V		9.8" x 3" x 3"
PSDM-200W-12V		9.8" x 3" x 3"
PSDM-300W-12V		9.8" x 4.2" x 3.5"
PSDM-300W-12V		7.0" x 7.0" x 3.2"
PSDM-20W-24V	CLASS 2	5.6" x 2" x 2.14"
PSDM-40W-24V	CLASS 2	5.6" x 2" x 2.14"
PSDM-60W-24V	CLASS 2	6.5" x 2.3" x 2.5"
PSDM-100W-24V	CLASS 2	6.5" x 2.3" x 2.5"
PSDM-150W-24V		9.8" x 3" x 3"
PSDM-192W-24V	CLASS 2	7.0" x 7.0" x 3.2"
PSDM-200W-24V		9.8" x 3" x 3"
PSDM-288W-24V	CLASS 2	9.8" x 4.2" x 3.5"
PSDM-300W-24V		7.0" x 7.0" x 3.2"

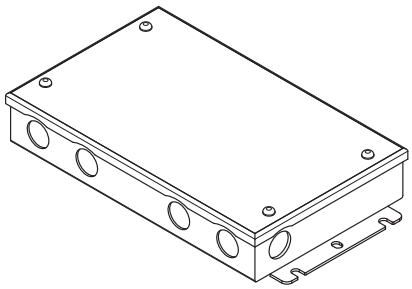


PSDH SERIES | HIGH PERFORMANCE MAGNETIC LOW VOLTAGE (MLV)

PSDH-48W-24V	CLASS 2	11.25"x 3.37"x 3.25"
PSDH-96W-24V	CLASS 2	11.25"x 3.37"x 3.25"
PSDH-288W-24V	CLASS 2	14.25"x 8.43"x 4.43"

150 West Carob St., Compton, CA 90220
info@corelightingusa.com | www.corelightingusa.com
T: 888.737.9192 | F: 888.789.4643

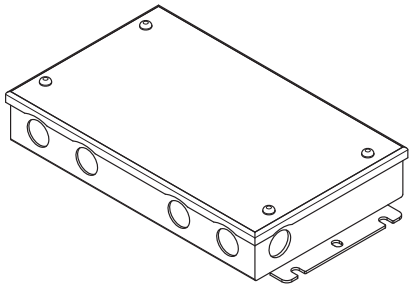
COMPATIBLE TRANSFORMERS



PSDL SERIES | TRIAC DIMMABLE

PSDL-30W-12V	CLASS 2	6.5"x 3.63"x 1.03"
PSDL-60W-12V	CLASS 2	7.4"x 3.63"x 1.03"
PSDL-100W-12V	CLASS 2	8.67"x 3.67"x 1.62"
PSDL-120W-12V		8.67"x 3.67"x 1.62"
PSDL-150W-12V		10.25"x 4.06"x 1.82"
PSDL-200W-12V		10.25"x 4.06"x 1.82"
PSDL-300W-12V		10.25"x 4.06"x 1.82"

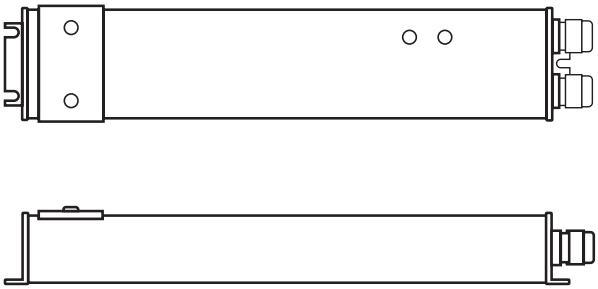
PSDL-30W-24V	CLASS 2	6.5"x 3.63"x 1.03"
PSDL-60W-24V	CLASS 2	7.4"x 3.63"x 1.03"
PSDL-96W-24V	CLASS 2	8.67"x 3.67"x 1.62"
PSDL-150W-24V	CLASS 2	8.67"x 3.67"x 1.62"
PSDL-192W-24V	CLASS 2	10.25"x 4.06"x 1.82"
PSDL-200W-24V		10.25"x 4.06"x 1.82"
PSDL-288W-24V		10.25"x 4.06"x 1.82"
PSDL-300W-24V		10.25"x 4.06"x 1.82"



PSHK SERIES | NON-DIMMING W/ JUNCTION BOX

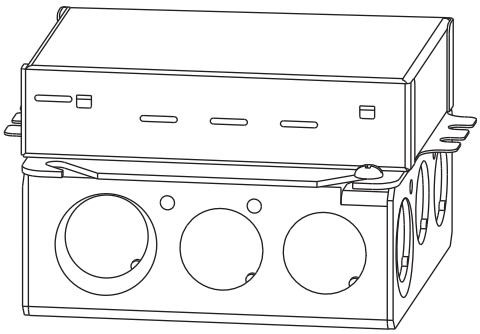
PSHK-30W-24V-UNV	CLASS 2	6.5" X 3.6" X 1.02"
PSHK-60W-24V-UNV	CLASS 2	7.4" X 3.62" X 1.02"
PSHK-96W-24V-UNV	CLASS 2	8.66" X 3.66" X 1.61"
PSHK-150W-24V-UNV		10.24" X 4.06" X 1.81"
PSHK-200W-24V-UNV		10.24" X 4.06" X 1.81"
PSHK-300W-24V-UNV		10.94" X 4.25" X 1.81"

COMPATIBLE TRANSFORMERS



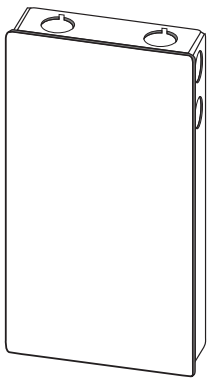
PSDE SERIES | 0-10V DIMMING W/ JUNCTION BOX

PSDE-100W-24V-010-JB	CLASS 2	12.32" x 1.77" x 1.67"



LUTRON 1% | 2 OR 3-WIRE DIMMING

LTEA4U1UKL-CV240	CLASS 2	4.0" x 1.5" x 4.0"
L3DA4U1UKL-CV240	CLASS 2	4.0" x 1.5" x 4.0"



LUTRON 1%

PSDE-96W-24V-ECO	CLASS 2	10.5" x 3.0" x 2.0"

ELT-11

Photometric Report (Type C)

Filename: LSMW-15-40K-24V-HR95_IESNA2002.IES
[TESTLAB] EVERFINE
[ISSUEDATE] 2006-10-01 02:02:19

Maximum Candela = 38.52 at 0 H 3 V

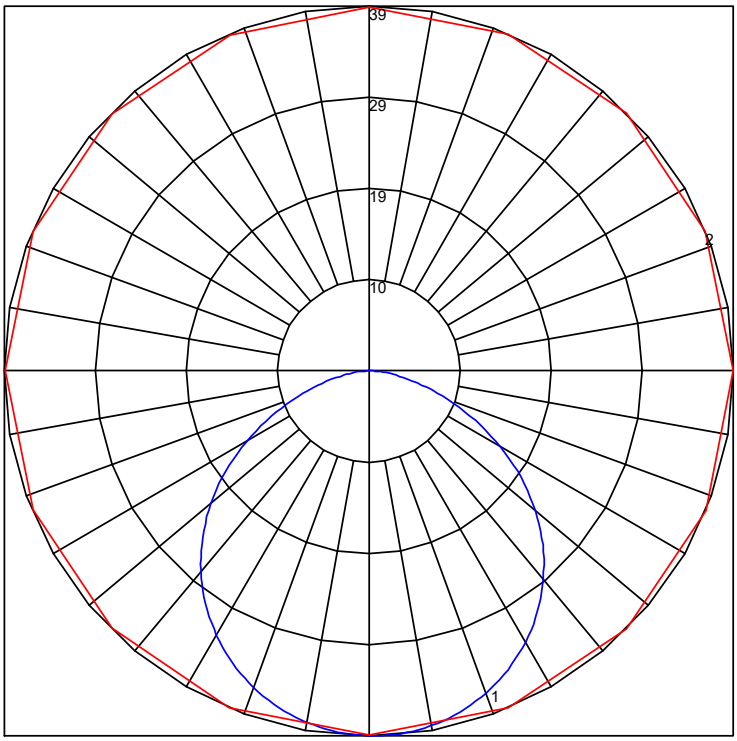
Classification:

Road Classification: Type VS, Very Short, Cutoff (deprecated)
Upward Wast Light Ratio: 0.04
Luminaire Efficacy Rating (LER): 74
Maximum UGR: 25.3
Indoor Classification: Direct
BUG Rating : B0-U1-G0

Polar Candela Curves:

Vertical Plane Through:
1) 0 - 180 Horizontal

Horizontal Cone Through:
2) 3 Vertical



ELT-11

Photometric Report (Type C)

Filename: LSMW-15-40K-24V-HR95_IESNA2002.IES
[TESTLAB] EVERFINE
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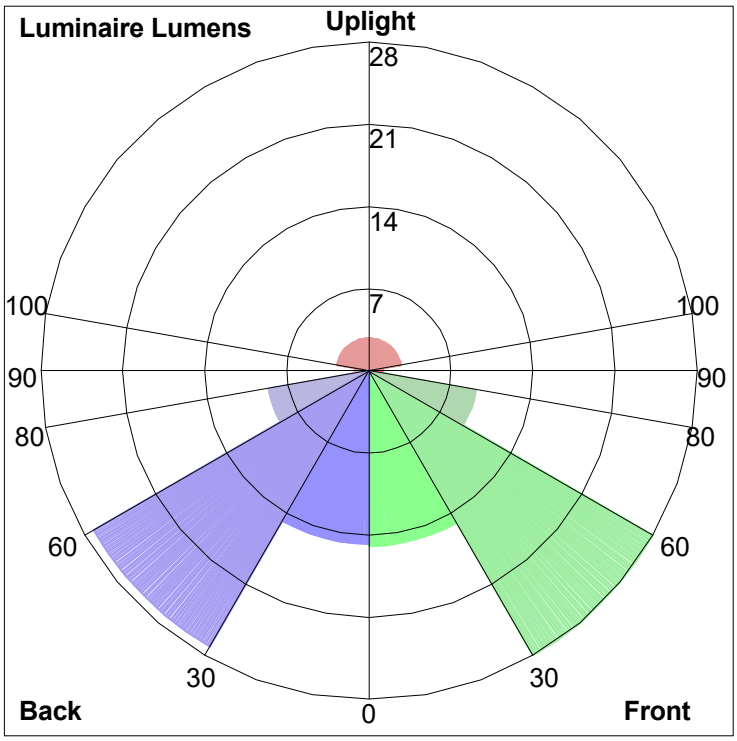
Classification:

Road Classification: Type VS, Very Short, Cutoff (deprecated)
Upward Waste Light Ratio: 0.04
Luminaire Efficacy Rating (LER): 74
Maximum UGR: 25.3
Indoor Classification: Direct
BUG Rating : B0-U1-G0

LCS Summary:

LCS Zone	Lumens	%Lamp	%Lum
FL (0-30)	15.1	13.7	13.7
FM (30-60)	28.2	25.7	25.7
FH (60-80)	9.4	8.5	8.5
FVH (80-90)	1.2	1.1	1.1
BL (0-30)	14.9	13.5	13.5
BM (30-60)	27.4	24.9	24.9
BH (60-80)	8.8	8.0	8.0
BVH (80-90)	1.1	1.0	1.0
UL (90-100)	1.2	1.1	1.1
UH (100-180)	2.8	2.6	2.6
Total	110.1	100.1	100.0
BUG Rating	B0-U1-G0		



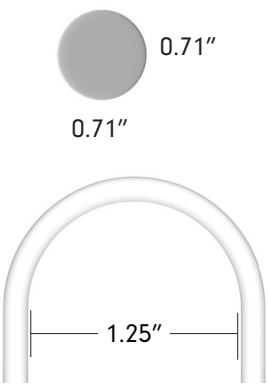
tivoli

FlexileSM

Project: _____ Type: _____

- Compare to traditional neon 360° lighted surface illuminates uniformly without any shadowing
- High luminous efficiency with LM80 report
- Easily bend to any shape with superior flexibility
- UV Stabilized with food-grade environmental silicone housing (no yellowing or cracking)
- Resistance to saline solutions, acids, alkali, and corrosive gases
- Low Voltage 24V DC

Dimensions



Order Specification Guide

PRODUCT CODE	PROFILE	POWER LEAD DIRECTION	LED COLOR	LENGTH	VOLTAGE
FLX	**SM**				**24**
FLX = Flexile 360° Light	**SM** = Small	**F** = Front **S** = Side	**23** = 2300K **27** = 2700K **30** = 3000K **35** = 3500K **40** = 4000K	**024** = 2' **048** = 4' **096** = 8' **195** = 16.25' For custom cut lengths consult factory for lead time and MOQ	**24** = 24V DC

Extra Lead Prep

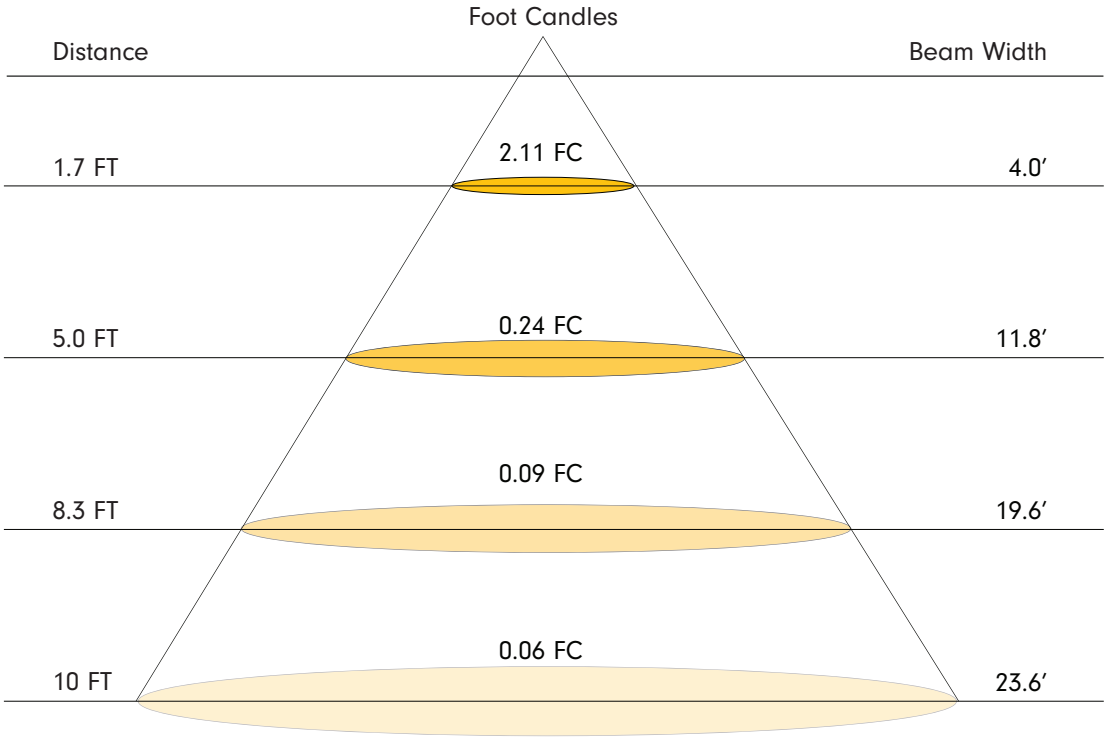
FLX-XEP
Extra lead wire for extended length.
Sold per ft.

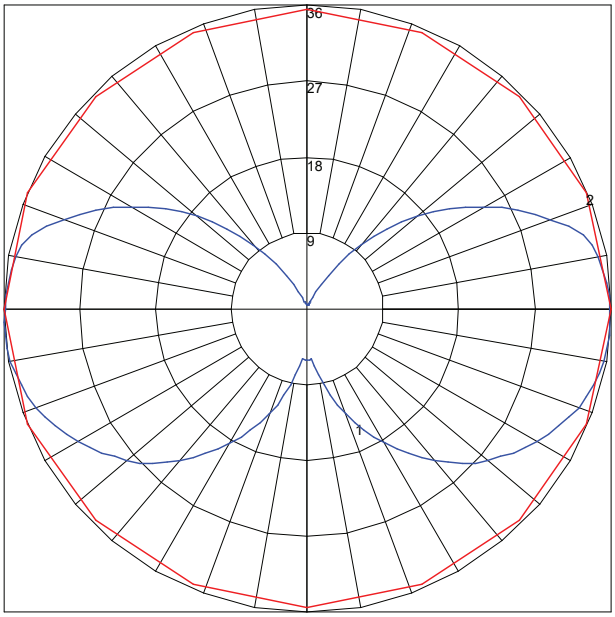
Specifications

LED Intensity	**2300K**	**2700K**	**3000K**	**3500K**	**4000K**
Lumens (lm/ft)	285	295	310	N/A	321
Beam Angle	360°				
Efficacy (lm/W)	63.3	65.5	68.8	N/A	71
CRI	95	95	95	95	95
Electrical					
Dimming	TRIAC, ELV, MLV, 0-10V, DMX				
Input Voltage	24V DC				
Power Consumption (W/ft)	4.5				
Maximum Electrical Run	20'				
Maximum Mechanical Run	16.25'				
Physical					
Dimensions (DIA)	0.71"				
Cut Increments	1"				
Bend Radius	1.25"				
Material	Flame, UV, Solvent, Saltwater Resistant Silicone				
Storage Temperature	-0°C / -32°F ~ 60°C / 140°F				
Working Temperature	-30°C / -86°F ~ 55° / 131°F				
Certification and Testing					
Certification	UL, CE, RoHS, IK08				
Environment	Dry Location				
Rated Hours (TM80)	70000 hrs.				
Warranty	3 Years				

Photometrics

Note: Data is based on 3000K





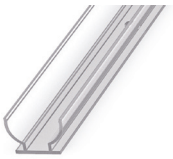
Maximum Candela = 35.9 Located At Horizontal Angle = 0, Vertical Angle = 85
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (85) (Through Max. Cd.)

Mounting Options

FLX-SM-CL-CLIP
PC clip closed 1
Mount spacing 15″
Bend diameter 2.5″
sold each

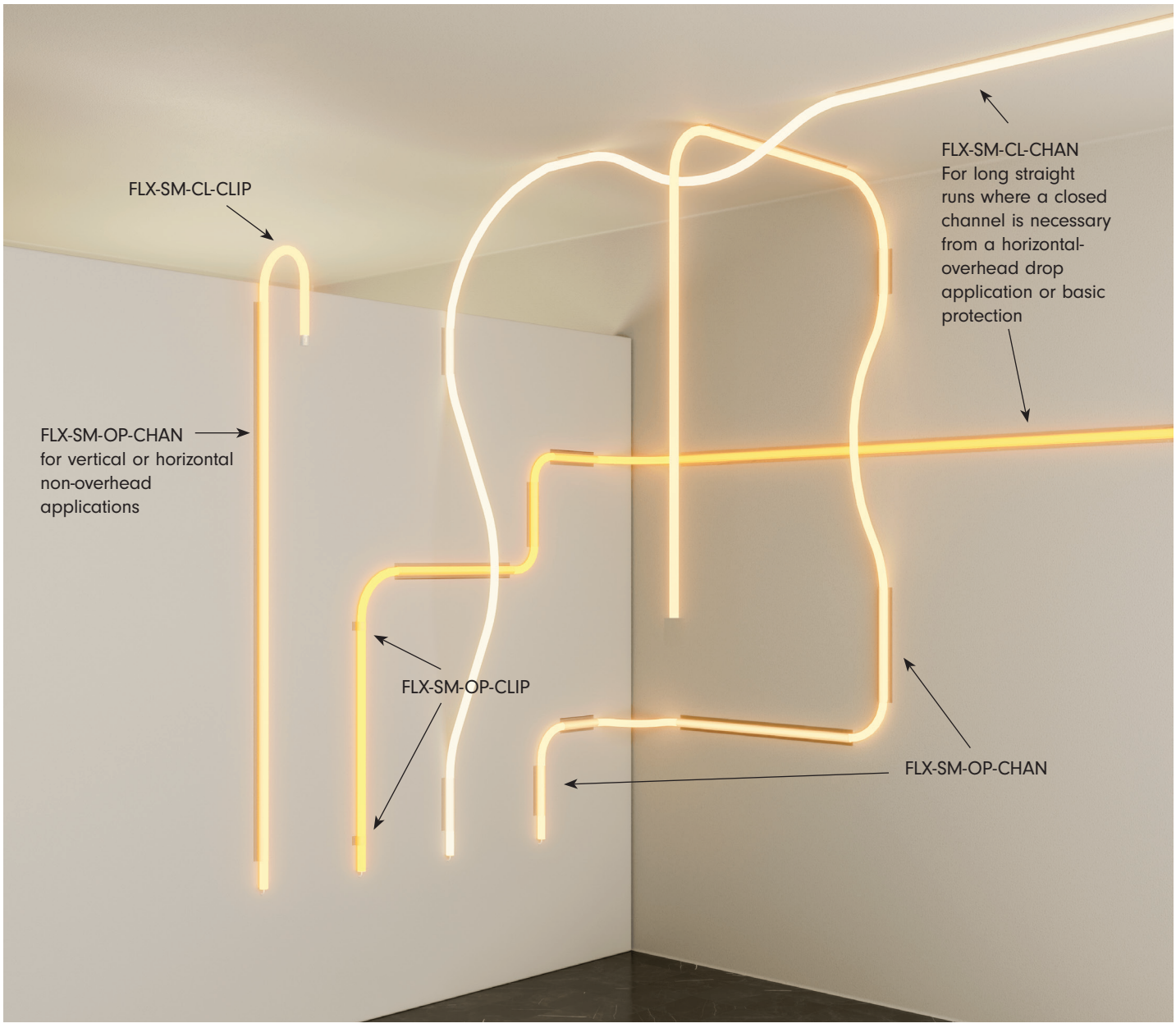
FLX-SM-CL-CHAN
PC channel closed 6.5
Bend diameter 2.5‴
sold each

FLX-SM-OP-CLIP
PC clip open 2.36″
Mounting spacing 15″
Bend diameter 3″
*sold each



FLX-SM-OP-CHAN
PC channel open 6.5′
Bend diameter 3″
*sold each

*Not for horizontal overhead application



Power Supplies - Indoor & Outdoor Cont.

INFINITY - MLV / ELV / 0-10V / PWM / TRIAC DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MIN LOAD	MAX LOAD	CIRCUIT CAPACITY
Infinity Series Class 2 Transformer	INF-J-30-1-1.3-24	Indoor / Outdoor	100 - 277V AC	24V DC	1	3W	30W	1.3A
	INF-J-60-1-2.5-24				1	6W	60W	2.5A
	INF-J-96-1-4-24				1	9W	96W	4A
	INF-J-192-2-4-24				2	2x9W	2x96W	2x4A
	INF-J-288-3-4-24				3	3X9W	3x96W	3x4A

Power Supplies - Indoor Only

ADUL - NON DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-D	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-D				2	2x96W	2x4A
	ADUL-320-3-4-24-D				3	3x96W	3x4A

ADUL - 0-10V DIMMING

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DOT	Indoor / Damp	100-277V AC 50/60 HZ	24V DC	1	96W	4A
	ADUL-240-2-4-24-DOT				2	2x96W	2x4A
	ADUL-320-3-4-24-DOT				3	3x96W	3x4A

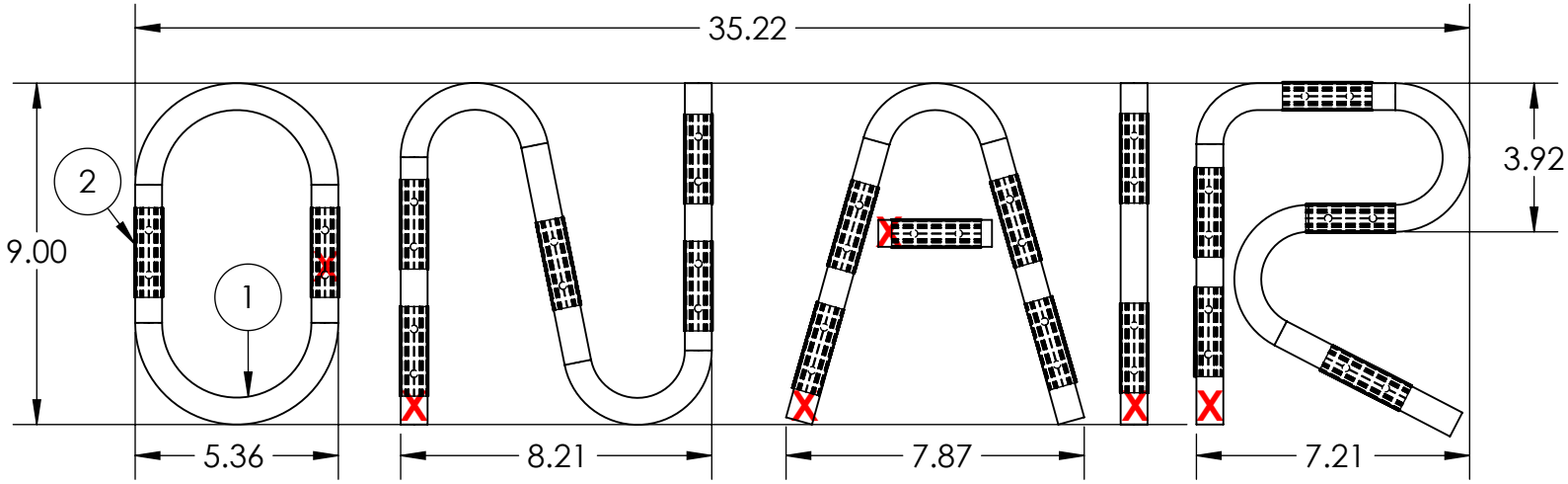
ADUL - DMX SUB CONTROLLER (Single Address)

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-120-1-4-24-DIN	Indoor / Damp	100-277V AC 50/60 Hz	24V DC	1	96W	4A
	ADUL-240-2-4-24-DIN				2	2x96W	2x4A
	ADUL-320-3-4-24-DIN				3	3x96W	3x4A

ADUL - DMX SUB CONTROLLER (Multi Address)

DESCRIPTION	CAT NO	APPLICATION	PRIMARY VOLTAGE	SECONDARY VOLTAGE	CIRCUIT BREAKERS	MAX LOAD	CIRCUIT CAPACITY
ADUL Series Class 2 Transformer	ADUL-240-2-4-24-DIN-2	Indoor / Damp	100-277V AC 50/60 Hz	24V DC	2	2x96W	2x4A
	ADUL-320-3-4-24-DIN-3				3	3x96W	3x4A

REVISIONS					
REV.	DESCRIPTION	ECN	DATE	DRAWN BY	APPROVED BY
B	LED and mounting details added		12/8/2022	Marc V.	



NOTES:

- Total Wattage: 41W, 1.7A @ 24V DC
- Power Supply: INF-J-96-1-4-24

- "X" denotes location of power feeds. Power feeds are fed through the mounting surface.

- Drill hole/slot in the the mounting clip for letter "O". Power feed will go through clip and into mounting surface.

- Custom lengths of Flexile are cut from offered lengths referenced on spec sheet.

Lengths:
"O" : 24 in.
"N" : 29 in.
"A" : 19 in. & 3 in.
" I " : 9 in.
"R" : 30 in.

ITEM NO.	PART NUMBER	DESCRIPTION	CUT LENGTH	QTY.
1	FLX-SM-S-XX-024-24	Flexile SM, CCT TBD, 2 FT, Side Power Lead, 4.5 WATT/FT, 24 V	24 in.	1
			19 in.	1
			3 in.	1
			9 in.	1
	FLX-SM-S-XX-048-24	Flexile SM, CCT TBD, 4 FT, Side Power Lead, 4.5 WATT/FT, 24 V	29 in.	1
			30 in.	1
2	FLX-SM-OP-CLIP	Flexile SM PC Open Mounting Clip, 2.36In	N/A	19

TIVOLI, LLC
17110 ARMSTRONG AVE
IRVINE, CA USA 92614

NAME
Flexile SM "ON AIR"

DRAWN BY	DATE	SCALE	SHEET
Marc V.	**12/07/22**	1:5	1 OF 1

APPROVED BY	DATE	TOLERANCE: UNLESS OTHERWISE SPECIFIED
Allen L.		FRACTION: ±1/64 .XXX DEC: ±.005 .XX DEC: ±.03 ANGULAR: ±1

SHT SIZE	DRAWING/PART NUMBER	REV
A	**SBTV00139**	**B**

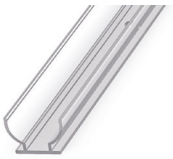
TIVOLI, LLC
17110 ARMSTRONG AVE
IRVINE, CA USA 92614
TEL.(714) 957-6101 FAX:(714) 427-3458

Mounting Options

FLX-SM-CL-CLIP
PC clip closed 1
Mount spacing 15″
Bend diameter 2.5″
sold each

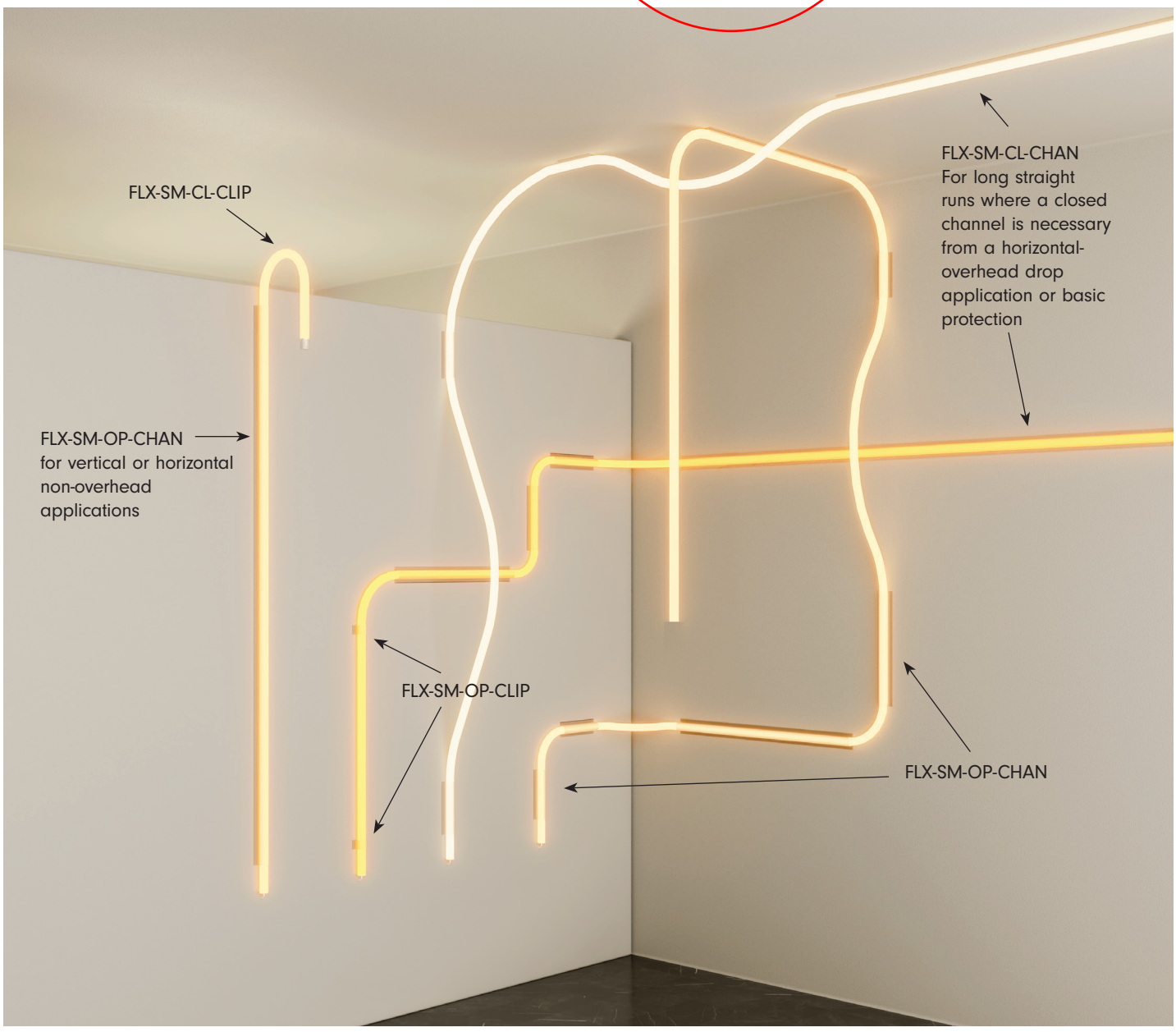
FLX-SM-CL-CHAN
PC channel closed 6.5
Bend diameter 2.5‴
sold each

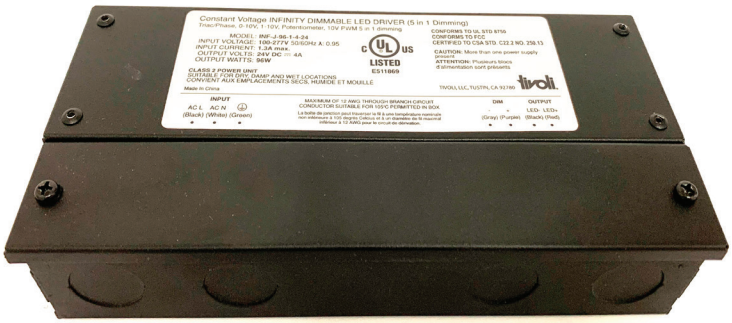
FLX-SM-OP-CLIP
PC clip open 2.36″
Mounting spacing 15″
Bend diameter 3″
*sold each



FLX-SM-OP-CHAN
PC channel open 6.5′
Bend diameter 3″
*sold each

*Not for horizontal overhead application





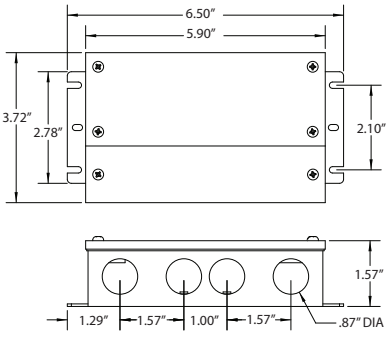
Project: _____ Type: _____

Product Features

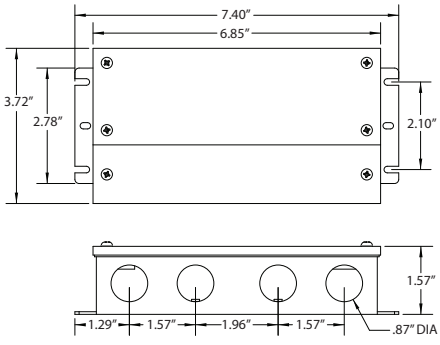
- Constant Voltage Output
- Universal 100-277VAC Input
- Single Channel
- Class 2
- Class A Sound Rating
- Power Factor up to 0.99
- 10 - 100% load
- Variety of dimming options: ELV, MLV, TRIAC, 0-10V and PWM
- Wet location
- Short circuit, Overload and over heat protection
- Built-in active PFC function
- Flicker-free
- 3 Year Warranty

Dimensions

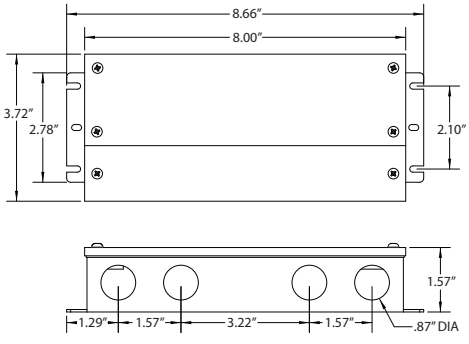
6.50″(L) x 3.72″(W) x 1.57″(H)
INF-J-30-1-2.5-12, INF-J-30-1-1.3-24



7.40″(L) x 3.72″(W) x 1.57″(H)
INF-J-60-1-5-12, INF-J-60-1-2.5-24



8.66″(L) x 3.72″(W) x 1.57″(H)
INF-J-96-1-4-24



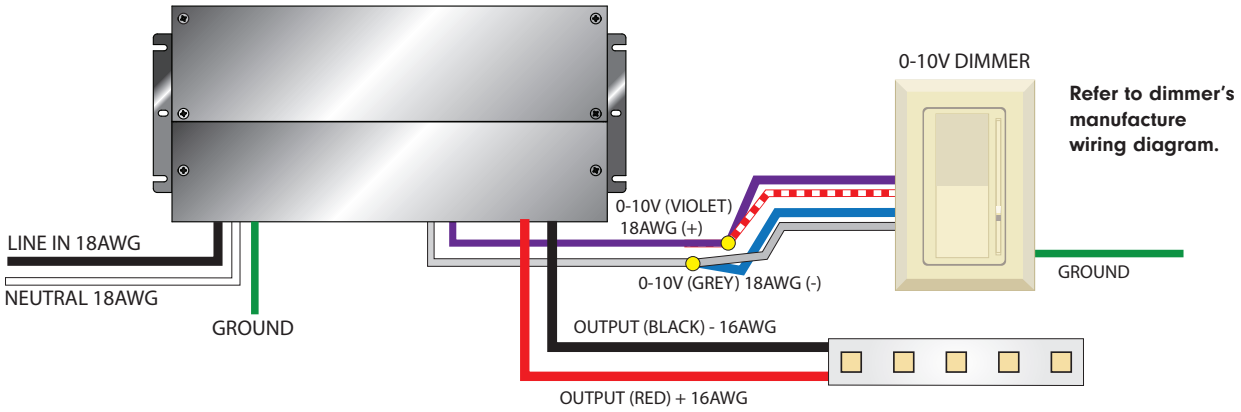
www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

Order and Specification Guide

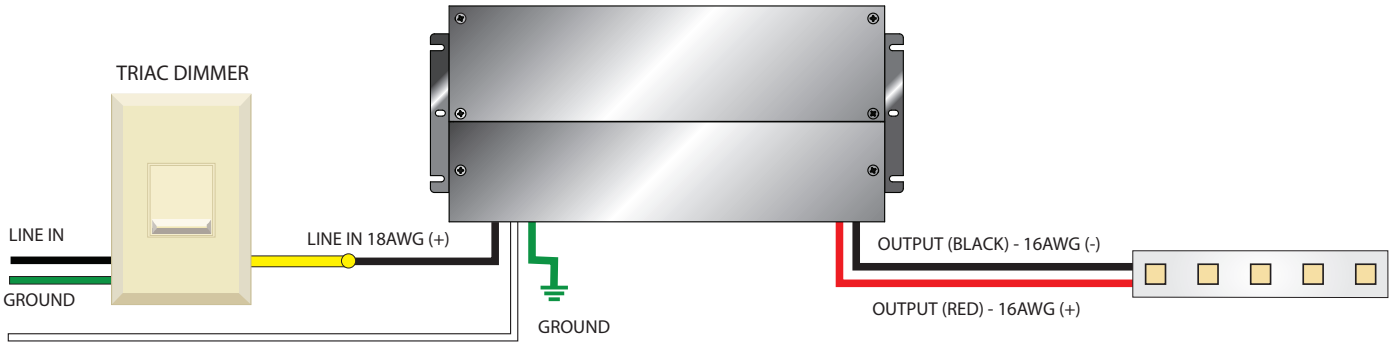
CAT NO.	INF-J-30-1-2.5-12	INF-J-30-1-1.3-24	INF-J-60-1-5-12	INF-J-60-1-2.5-24	INF-J-96-1-4-24
DC Voltage	12V	24V	12V	24V	24V
Transformer Classification	Class 2				
Rated Current	2.5A	1.3A	5A	2.5A	4A
Rated Power	30W	30W	60W	60W	96W
Number of Channel(s)	1				
Dimming	Forward Phase (MLV), TRIAC, Reversed Phase (ELV), 0-10V, PWM				
Voltage Regulation	±0.5%				
Output					
Input Voltage	100-277VAC				
Frequency Range	47-63Hz				
Power Factor (Typ.) @ full load	0.99@120VAC 0.98@277VAC		0.98@120VAC 0.95@277VAC		
THD (Typ.) @ full load	<20%				
Efficiency (Typ.) @ full load	79% @120VAC 80% @277VAC		83% @120VAC 86% @277VAC		
AC Current (Max.)	0.5A @100VAC				1.3A @ 100VAC
Inrush Current (Typ.)	7A, 50%, 420us @ 120V AC 12A, 50%, 480us @ 277V AC		14A, 50%, 780us @ 120V AC 15A, 50%, 660us @ 277V AC		20A, 50%, 1.6ms
Physical					
Net Weight	1.90 lbs		2.25 lbs		2.75 lbs
Dimension	6.50″(L) 3.72″(W) 1.57″(H)		7.40″(L) 3.72″(W) 1.57″(H)		8.66″(L) 3.72″(W) 1.57″(H)
Protection					
Short Circuit	Shut down o/p voltage, re-power on to reset the condition				
Over loading	≥120% shutdown o/p voltage, re-power to reset the condition				
Over heating	100˚C ± 10˚C shut down o/p voltage, automatically recover after cooling				
Environment					
Working Temp.	-40˚ to 60˚C (-40˚ to 140˚F)				
Working Humidity	20-90% RH, non-condensing				
Storage Temp	-40˚ to 80˚C (-40˚ to 176˚F)				
Storage Humidity	10-95% RH				
Temp. Coefficient	±0.03%/˚C (0-50˚C)				
Vibration	10-500Hz, 5G 10 min./1 cycle, period for 60 min., each along X, Y, Z axis				
Safety Compliance & EMC					
Certification	UL 8750, Type HL UL 1310				
Sound Rating	Class A - SPL (dba) 16.8 @ 20% 16.4 @ 100%				
Environment	Wet Location				
Withstand Voltage	I/P-O/P:1.88KVAC				
Isolation Resistance	I/P-O/P:100M Ω/500VDC/25˚C/70%RH				
EMC Emission	FCC 47 CFR Part 15, Subpart B				

Wiring Diagram

PWM, 0-10V Dimmer Diagram



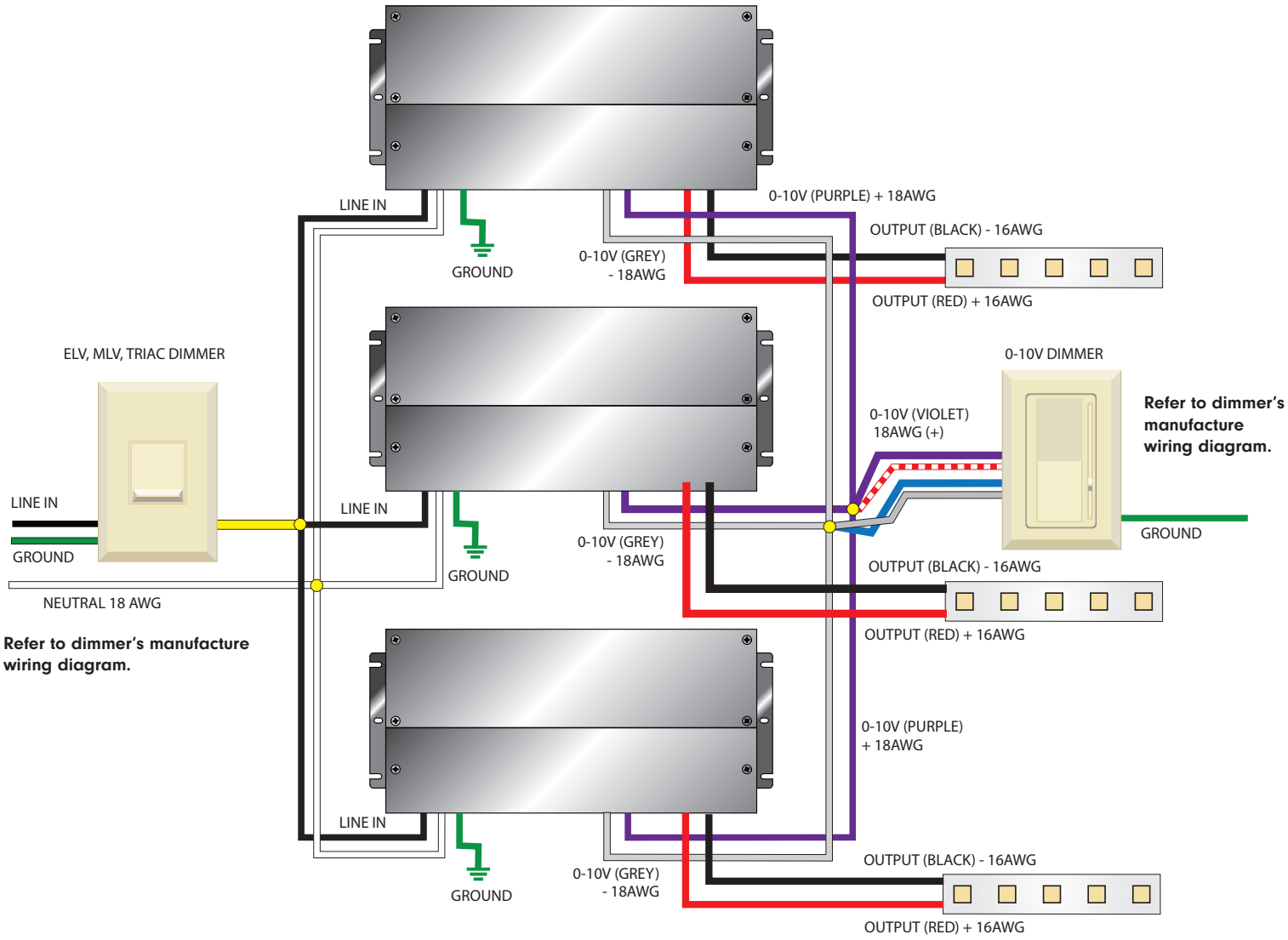
MLV, ELV, TRIAC Dimmer Diagram



Refer to dimmer's manufacture wiring diagram.

www.tivolilighting.com tel: 714-957-6101 fax: 714-427-3458

Dual Dimmer Diagram



Wire Gauge between driver and LED fixture

tivoli	12VDC				
	American Wire Gauge(AWG)				
Length (feet)	current (Amps)				
	1	2	3	4	5
5	18	18	18	18	18
10	18	18	18	16	16
15	18	18	16	14	14
20	18	16	14	14	12
25	18	16	14	12	12
30	16	14	12	12	10
40	16	14	12	10	10
50	16	12	10	10	8
60	14	12	10	8	8
70	14	10	10	8	8
80	14	10	8	8	6
90	12	10	8	6	6
100	12	10	8	6	6
110	12	8	8	6	4

tivoli	24VDC			
	American Wire Gauge(AWG)			
Length (feet)	current (Amps)			
	1	2	3	4
5	18	18	18	18
10	18	18	18	18
15	18	18	18	18
20	18	18	18	16
25	18	18	16	14
30	18	18	16	14
40	18	16	14	14
50	18	16	14	12
60	18	14	12	12
70	16	14	12	10
80	16	12	12	10
90	16	12	10	10
100	14	12	10	10
110	14	12	10	8

Received
By PCM3 at 12:54 pm, April 27, 2023

Date: _____ Customer: _____

Project: Compton College -VAPA

Type: LT-01 SERIES Qty: _____

selux

M60
LED Recessed

Order Code: _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

Series

L60	L6R1	L6R2
Multi-Mount Form	Continuous Flange (Flanged Endcaps)	Continuous Flange (Flangeless Endcaps)

Light Engine

1C45[1,2,3]	1C40[1,2,3]	1C35[1]	1C30[1,2]	1C25[1,2]	1C20[1,2]
80CRI-1018lm 90CRI-855lm 11.1W per foot	80CRI-954lm 90CRI-802lm 9.9W per foot	80CRI-834lm 90CRI-701lm 8.7W per foot	80CRI-746lm 90CRI-627lm 7.3W per foot	80CRI-594lm 90CRI-500lm 6.1W per foot	80CRI-494lm 90CRI-415lm 4.9W per foot

[1] Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2.
[2] Available starting at 2' and up
[3] Not available with Lutron

CCT

927	930	935	940	827[4]	830[4]	835[4]	840[4]	RGBW
2700K 90+ CRI	3000K 90+ CRI	3500K 90+ CRI	4000K 90+ CRI	2700K 80+ CRI	3000K 80+ CRI	3500K 80+ CRI	4000K 80+ CRI	(consult factory)

[4] Consult factory for lead times.

Shielding

LW	MI	NB	A2	A5	BW
LED Optimized White Lens	Clear Lens with Microprism	LMO Symmetric with Satine Lens	LMO Asymmetric 20° Wall Washer with Satine Lens	LMO Asymmetric 5° Wall Grazer with Satine Lens	LMO Batwing with Satine Lens

Mounting L60 or Mounting L6R1 or L6R2

SF1	SF2	SF3	SG	DC
Spackle Flange (½" Drywall)	Spackle Flange (⅝" Drywall)	Spackle Flange (After Drywall)	Slot Grid (9/16") (Wire Suspension or ¼"-20 stud)	Decoustic Ceiling (up to 2" thick)

TB[5]	TBS[5]	PMT[5]	RC[6]	TS	PM
T-Bar Length with suspension clips	T-Bar Length with 1" ¼"-20 Stud	T-Bar Length Perimeter Mount	Rotating Crossbar (Ceilings ¼" to 2" thick)	1" ¼"-20 Stud	Perimeter Mount

[5] L6R1 only
[6] Consult factory for lengths under 2'

Nominal Fixture Length

01*	02[7]	03	04[7]	05[7]	06[7]	07	08[7]	XX
1 ft.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.	7 ft.	8 ft.	Runs (over 8') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 09=09' nominal)

[7] Length intended to fit centered between the grid for SG, TB, TBS, PMT mountings

**1' fixture only available with 1C35 light engine.*
Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.

Finish

WH	BL	SV	SP
White	Semi-Matte Black	Silver	Specify Premium Color

** Custom colors are available, please consult factory*

Voltage

1	2	U	3[8]
120V	277V	120V through 277V 50/60hz capable	347V (consult factory)

[8] 347V not available with EM integral battery option

Driver

DIM[9]	DIL[9,10]	DED[9,10]	D01[9,10]	DL01[9,10]	DC2[9,10,11]	DE1[9,10]	DC5	DC3
0-10V 1% (Linear)	eldoLED 1% ECOdrive 0-10V (Logarithmic)	eldoLED 1% ECOdrive DALI (Logarithmic)	eldoLED 0.1% SOLOdrive 0-10V (Linear)	eldoLED 0.1% SOLOdrive 0-10V (Logarithmic)	Lutron 1% 2-Wire	Lutron 1% EcoSystem	Lutron 5% 5-Series (consult factory)	Lutron 1% 3-Wire (consult factory)

[9] See page 7 for full details
[10] Not available for 1' length
[11] 120V only

Fixture Options

DL	FS	SS[12]	CCEA
Damp Location Rated	In-line Fuse	Separate Switching	CCEA approved

[12] See page 10 for details

Sensor Options

xE[13,14]	xS1[13,14]	xS2[13,14]	xS3[13,14]	xSN	xV
Enlighted	Sensor Switch Daylight	Sensor Switch Occ/Vac/ Daylight	Sensor Switch Occ/Vac/ Daylight	nLight Enabled (consult factory)	Lutron Vive (consult factory)

Replace "x" with quantity

[13] Minimum fixture length 2'. See page 10 for full details and restrictions
[14] Requires DIM driver (0-10V)

Emergency Options

EC[15,16]	EMR	EM[15,16,17]
Emergency Circuit Wiring	Remote Micro Inverter (consult factory)	Integral EM Battery Pack (Non-IC rated)

[15] See page 8 for full details and restrictions
[16] For EM with sensors please consult factory
[17] 4' available with DIM driver only. ≥6' available with all driver options.

Configuration Options

L9[1]	V9	T9	X9
Lit Horizontal 90° Corner	Lit Inverted 90° Corner	Lit "T" section	Lit "X" section

*See pages 12-13 for full details and restrictions

All options indicated with the green truck symbol are available with 4-week ship time. Mixed orders will defer to the longest lead time.

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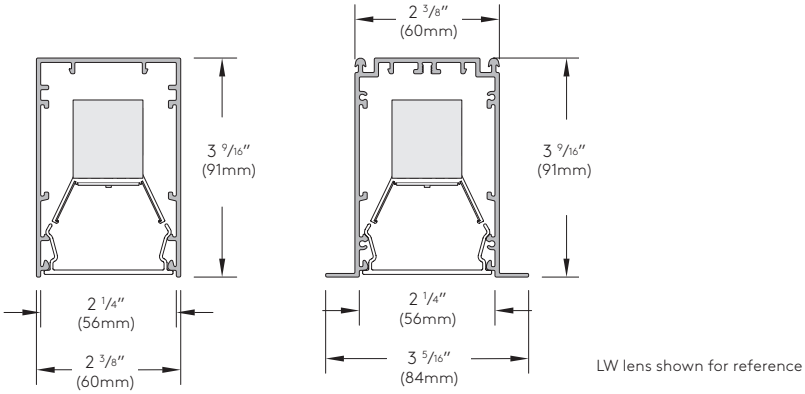

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 8') or Runs.

Flange (L6R1 or L6R2 Series)- 9/16" (14mm) wide flange runs full lengths of both sides and is part of the main extruded body. Specify continuous flange (L6R1) or flush (L6R2) end cap. L6R2 does not work in T-Bar ceiling.

Geartray - Low copper 6063-T6 extruded aluminum profile.

Shielding - Extruded, impact resistant acrylic snap in lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - Spackle-in (drywall), Slot grid, Decoustic, T-bar grid, Perimeter, Rotating Crossbar and Threaded Stud Mountings (see pages 3 through 6 for details).

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately 1/4" increments starting at the nominal 8' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with you requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaires.

L60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied L60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 10 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 14 for details.

CCT - Available in 2700K, 3000K, 3500K and 4000K, tolerance within a 3-step MacAdam ellipse.

CRI - 90+ and 80+ CRI. Consult factory for lead times of 80 CRI.

All Drivers - High efficiency, constant current, soft start, Electronic Class 2 with a PFC>0.90. For more detailed information on the available drivers please see page 7.

Sensors - Selux offers a variety of integral sensor options. For details and specifications, please refer to page 11.

Emergency - There are multiple emergency options available - Emergency Circuit, Remote Micro Inverter, and Integral EM Battery Pack. All options compliant with UL 924 listed emergency luminaire. Please consult factory for use of sensors with emergency options. For more details on EC and EM options, see page 10.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for maximum ambient temperature of 35°C (95°F) for all drivers.

Luminaires are suitable for minimum ambient temperatures of -40°C (-40°F) for DIM, DIL, DED, D01, and DL01 drivers; 0°C (32°F) for DC2 and DE1 drivers.

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

Warranty:

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

Certifications and Compliance:

NRTL - For Dry and Damp location
(I.E. cULus; cCSAus)
ARRA Compliant
RoHS Compliant
*EM option is non IC-rated

Received
By PCM3 at 12:54 pm, April 27, 2023

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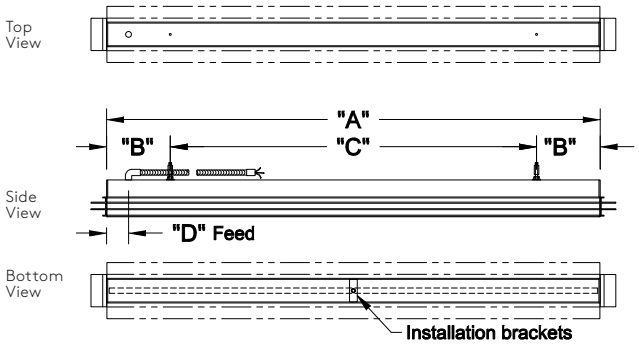
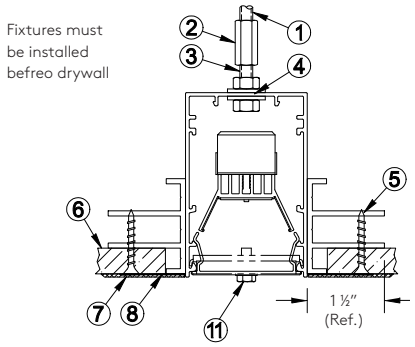
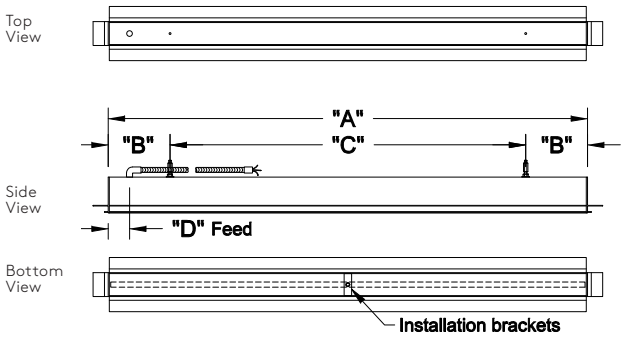
½" Spackle Flange Mounting (SF1)



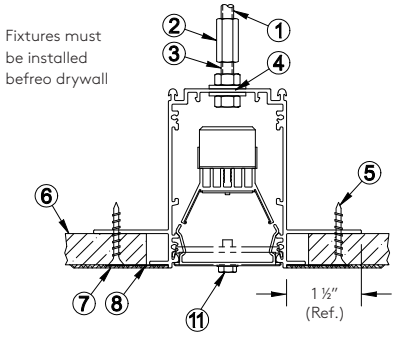
½" Spackle Flange Mounting (SF1)



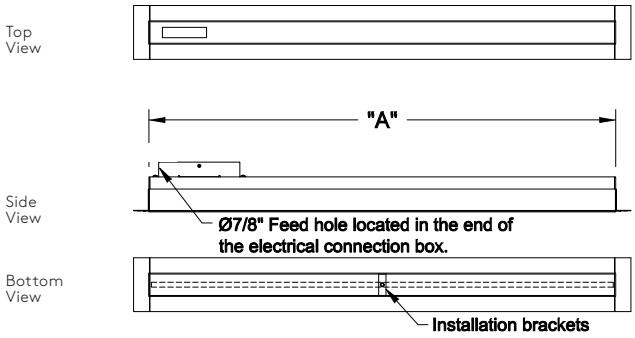
⅝" Spackle Flange Mounting (SF2)



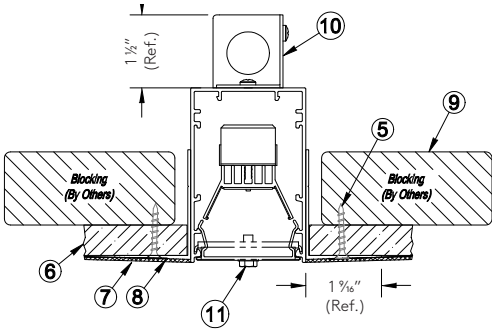
⅝" Spackle Flange Mounting (SF2)



After Drywall Flange Mounting (SF3)



After Drywall Flange Mounting (SF3)

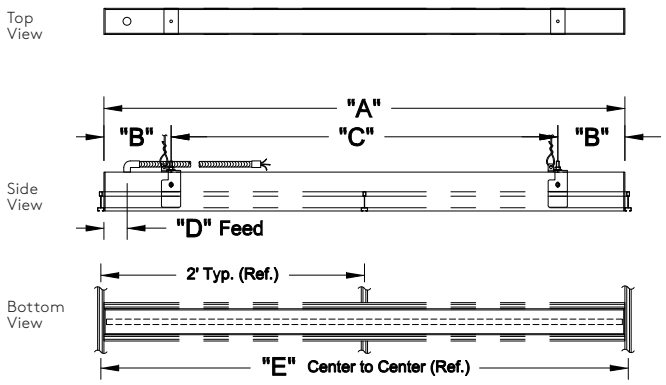


Spackle Flange Mounting (SF1, SF2 and SF3) - Dimensions								
Nominal Length	**"A" O.A.L. w/o Flange**		**"B" End Suspensions**		*** "C" (Ref.) Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1 ft.)	1' - ¼"	311	0' - 1 ⅝"	41	0' - 9"	229	0' - 4 ⅛"	105
02 (2 ft.)	2' - ¼"	616	0' -1 ⅝"	41	1' - 9"	533	0' - 4 ⅛"	105
03 (3 ft.)	3' - ¼"	921	0' -6 ⅛"	156	2' - 0"	609	0' - 2 ⅛"	54
04 (4 ft.)	4' - ¼"	1226	0' -6 ⅛"	156	3' - 0"	914	0' - 2 ⅛"	54
05 (5 ft.)	5' - ¼"	1530	0' -6 ⅛"	156	4' - 0"	1219	0' - 2 ⅛"	54
06 (6 ft.)	6' - ¼"	1835	0' -6 ⅛"	156	5' - 0"	1524	0' - 2 ⅛"	54
07 (7 ft.)	7' - ¼"	2140	0' -6 ⅛"	156	6' - 0"	1829	0' - 2 ⅛"	54
08 (8 ft.)	8' - ¼"	2445	0' -6 ⅛"	156	7' - 0"	2134	0' - 2 ⅛"	54

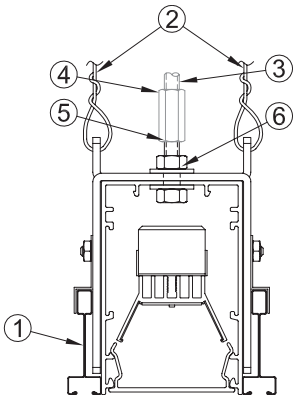
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to struture (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. Drywall/Drywall screw (Ref.)
6. Drywall/Drywall (Ref.)
7. ⅛" Plaster skimcoat (Ref.)
8. Drywall/Drywall tape (Ref.)
9. Blocking to secure fixture (by others)
10. Electrical connection box, removable side cover for electrical connection pre-installation, once installed the wiring is accessible from below the ceiling through the luminaire.
11. Luminaires ship with the brackets pre-installed.
    - The brackets cannot be removed until the fixture is completely installed and secured through the spackle flange.
    - Once the brackets are removed, the lens can be installed.

Slot Grid Mounting (SG)



9⁄16" Slot Grid Mounting (SG)
(Wire Suspension or ¼"-20 Stud)

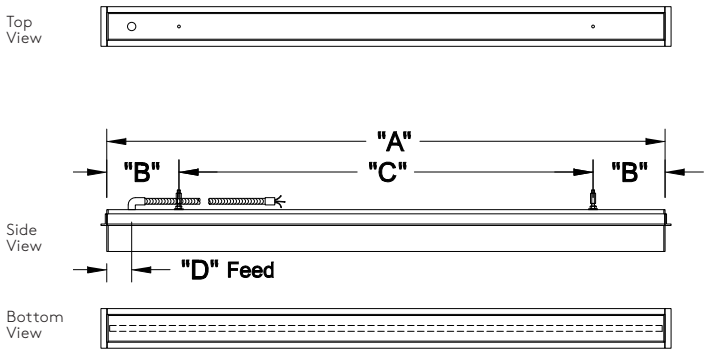


1. 9⁄16" Slot grid (shown as Ref.)
2. Support wire to structure (supplied and installed by others).
3. ¼"-20 Threaded rod to structure (supplied and installed by others).
4. ¼"-20 Coupler hardware (supplied and installed by others).
5. 1" ¼"-20 Stud (by Selux).
6. Ø5⁄16" (Ø7mm) mounting hole.

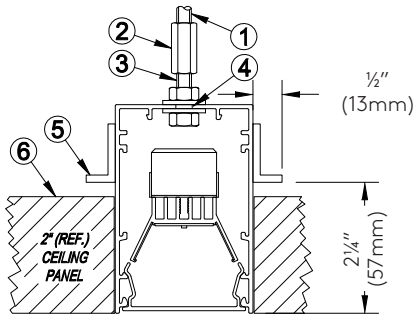
Slot Grid Mounting (SG) - Dimensions									
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" (Ref.) Mid. Suspension		"D" Feed Location		"E" Grid Spacing
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	
02 (2 ft.)	1' - 11 5⁄16"	592	0' -1 5⁄8"	41	1' - 5 3⁄16"	437	0' - 1 1⁄8"	29	2' Center to Center
04 (4 ft.)	3' - 11 5⁄16"	1202	0' - 6 1⁄8"	156	2' - 11 3⁄16"	894	0' - 2 1⁄8"	54	4' Center to Center
05 (5 ft.)	4' - 11 5⁄16"	1507	0' - 6 1⁄8"	156	3' - 11 3⁄16"	1199	0' - 2 1⁄8"	54	5' Center to Center
06 (6 ft.)	5' - 11 5⁄16"	1811	0' - 6 1⁄8"	156	5' - 11 3⁄16"	1504	0' - 2 1⁄8"	54	6' Center to Center
08 (8 ft.)	7' - 11 5⁄16"	2421	0' - 6 1⁄8"	156	6' - 11 3⁄16"	2113	0' - 2 1⁄8"	54	8' Center to Center

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

Decoustic Mounting (DC)



Decoustic Mounting (DC)
(Panels up to 2" thick)

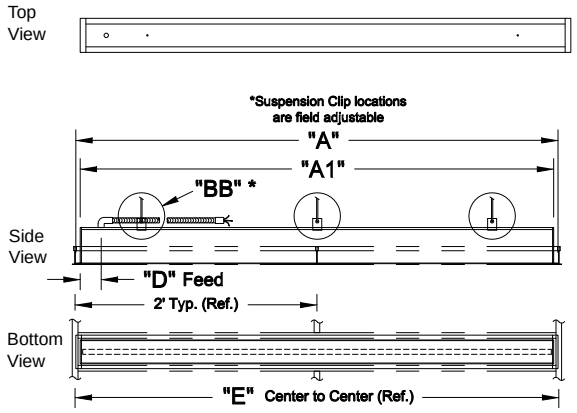


Decoustic Mounting (DC) - Dimensions								
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" (Ref.) Mid. Suspension		"D" Feed Location	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
01 (1 ft.)	1' - ¼"	311	1 5⁄8"	41	0' - 9"	229	0' - 4 1⁄8"	105
02 (2 ft.)	2' - ¼"	616	1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105
03 (3 ft.)	3' - ¼"	921	6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54
04 (4 ft.)	4' - ¼"	1226	6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54
05 (5 ft.)	5' - ¼"	1530	6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54
06 (6 ft.)	6' - ¼"	1835	6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54
07 (7 ft.)	7' - ¼"	2140	6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54
08 (8 ft.)	8' - ¼"	2445	6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54

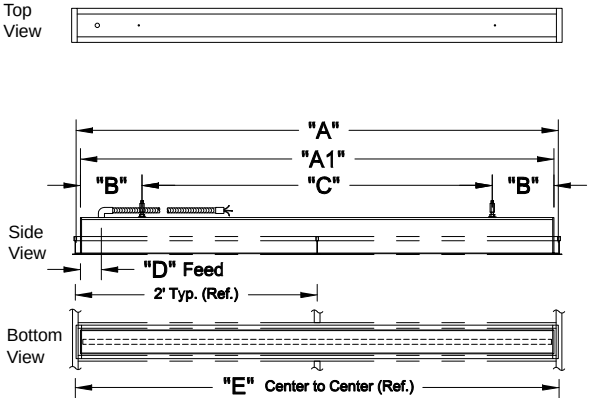
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to structure (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. ½" wide aluminum angle runs the entire length of fixture to block view into plenum area from below fixture.
6. Suitable for Decoustic® ceiling panel installations with panels up to 2" thick (supplied and installed by others). Other ceiling systems possible, please consult factory. Decoustic® is a registered trademark of Decoustics Ltd. Corporation.

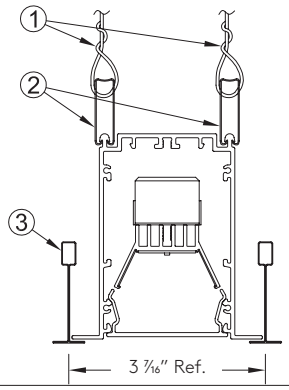
T-Bar Mounting (TB)



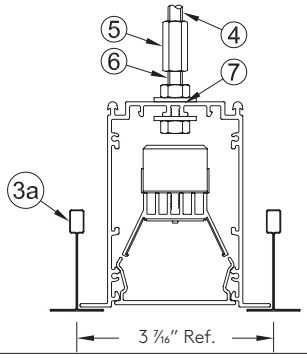
T-Bar with Stud Mounting (TBS)



T-Bar with Suspension Clips (TB)
(9/16" or 15/16" grid)



T-Bar with 1/4"-20 Stud (TBS)
(9/16" or 15/16" grid)



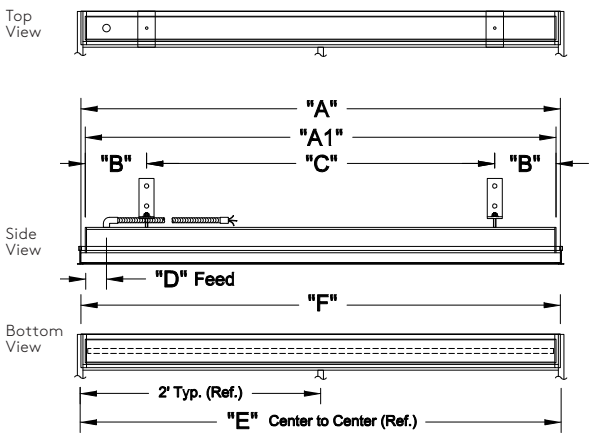
1. Support wire to structure (supplied and installed by others).
2. Spring steel suspension clips located approximately every 4 ft. (supplied by Selux).
3. 9/16" T-bar grid (shown as Ref.)
3a. 15/16" T-bar grid (shown as Ref.)
4. 1/4"-20 Threaded rod to structure (supplied and installed by others).
5. 1/4"-20 Coupler hardware (supplied and installed by others).
6. 1" 1/4"-20 Stud (by Selux).
7. Ø5/16" (Ø7mm) mounting hole.

T-Bar (TB and TBS) and Perimeter Mount (PMT) - Dimensions														
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		**"BB" (TB mtg.) Suspension Clips**	**** "C" (Ref.) Mid. Suspension**		**"D" Feed Location**		**"E" Grid Spacing**	**"F" Wall Angle**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Quantity**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**		**Feet/Inch**	**MM**
***02 (2 ft.)**	1' - 11 13/16"	605	1' - 11"	583	0' - 1 5/8"	41	4x	1' - 4 3/4"	425	0' - 1 1/8"	29	2' Center to Center	1' - 10 3/4"	577
***04 (4 ft.)**	3' - 11 13/16"	1215	3' - 11"	1193	0' - 6 5/8"	156	6x	2' - 10 3/4"	882	0' - 2 1/8"	54	4' Center to Center	3' - 10 3/4"	1187
***05 (5 ft.)**	4' - 11 13/16"	1519	4' - 11"	1497	0' - 6 5/8"	156	6x	3' - 10 3/4"	1187	0' - 2 1/8"	54	5' Center to Center	4' - 10 3/4"	1491
***06 (6 ft.)**	5' - 11 13/16"	1825	5' - 11"	1803	0' - 6 5/8"	156	6x	4' - 10 3/4"	1492	0' - 2 1/8"	54	6' Center to Center	5' - 10 3/4"	1787
***08 (8 ft.)**	7' - 11 13/16"	2434	7' - 11"	2412	0' - 6 5/8"	156	8x	6' - 10 3/4"	2101	0' - 2 1/8"	54	8' Center to Center	7' - 10 3/4"	2406

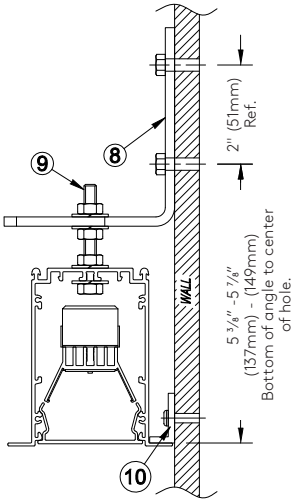
*For other lengths consult factory

**Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Perimeter Mounting T-Bar Length (PMT)

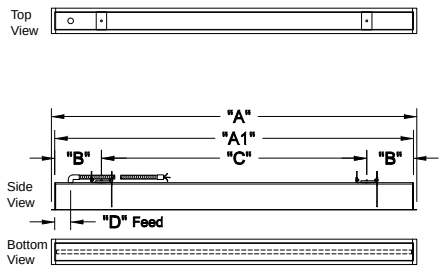


Perimeter Mount T-Bar Length (PMT)
(Recessed Wall Mounting)

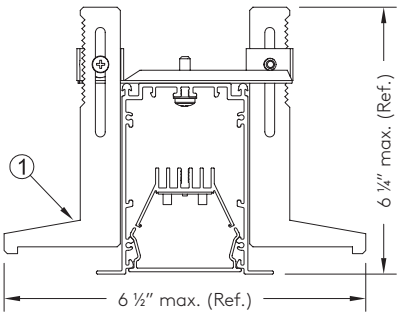


8. Steel Wall Bracket with provision for 1/4"-20 fasteners (hardware to code by others).
9. 2" 1/4"-20 Stud (by Selux).
10. 1/2" x 1" aluminum wall angle allows a gap between flange and wall to create shadow line allowing for uneveness of wall. Provision for #10 screws supplied approximately every 2 ft. (hardware to code by others).

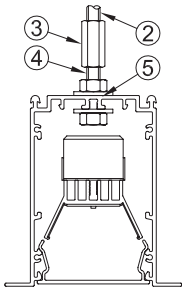
Rotating Crossbar Mounting (RC)



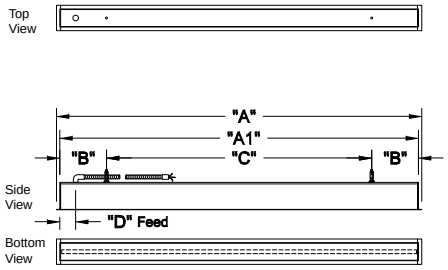
Rotating Crossbars (RC)
(¼" to 2" thick ceiling)



¼-20 Threaded Stud (TS)
(1" Threaded Stud)



¼"-20 Threaded Stud Mounting (TS)



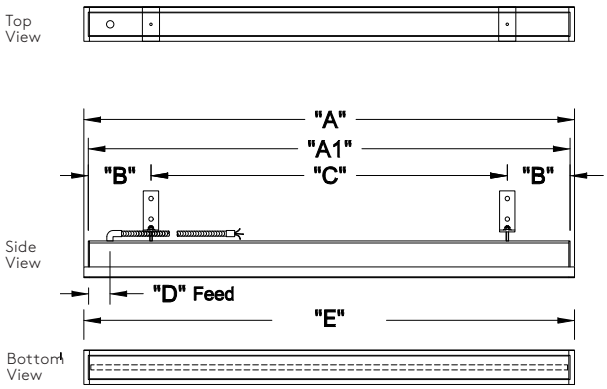
1. Rotating Crossbar intended for inaccessible ceilings, adjustable for ceiling thickness of ¼" to 2".
2. ¼"-20 Threaded rod to structure (supplied and installed by others).
3. ¼"-20 Coupler hardware (supplied and installed by others).
4. 1" ¼"-20 Stud (by Selux).
5. Ø5⁄16" (Ø7mm) mounting hole.

Rotating Crossbar (RC), Threaded Stud (TS), and Perimeter Mountings (PM) - Dimensions												
Nominal Length	"A" O.A.L. with Flange		"A1" O.A.L. without Flange		"B" End Suspensions		** "C" (Ref.) Mid. Suspension		"D" Feed Location		"E" Wall Angle	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
*01 (1 ft.)	1' - 1 1⁄8"	333	1' - ¼"	311	0' - 1 5⁄8"	41	0' - 9"	229	0' - 4 1⁄8"	105	1' - 0"	305
02 (2 ft.)	2' - 1 1⁄8"	638	2' - ¼"	616	0' - 1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105	2' - 0"	610
03 (3 ft.)	3' - 1 1⁄8"	942	3' - ¼"	921	0' - 6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54	3' - 0"	914
04 (4 ft.)	4' - 1 1⁄8"	1247	4' - ¼"	1226	0' - 6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54	4' - 0"	1219
05 (5 ft.)	5' - 1 1⁄8"	1552	5' - ¼"	1530	0' - 6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54	5' - 0"	1524
06 (6 ft.)	6' - 1 1⁄8"	1857	6' - ¼"	1835	0' - 6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54	6' - 0"	1829
07 (7 ft.)	7' - 1 1⁄8"	2162	7' - ¼"	2140	0' - 6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54	7' - 0"	2134
08 (8 ft.)	8' - 1 1⁄8"	2466	8' - ¼"	2445	0' - 6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54	8' - 0"	2438

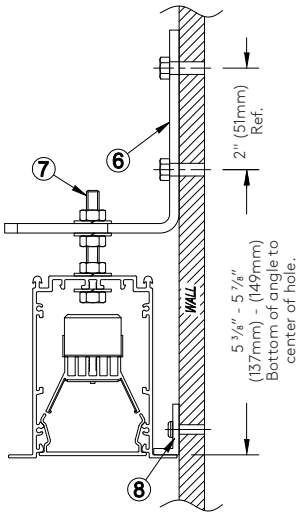
*RC mounting, consult factory for lengths under 2'

**Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

Perimeter Mounting (PM)



Perimeter Mount (PM)
(Recessed Wall Mounting)



6. Steel Wall Bracket with provision for ¼"-20 fasteners (hardware to code by others).
7. 2" ¼"-20 Stud (by Selux).
8. ½" x 1" aluminum wall angle allows a gap between flange and wall to create shadow line allowing for uneveness of wall. Provision for #10 screws supplied approximately every 2 feet (hardware to code by others).

Drivers:

0-10V linear dimming (DIM)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 1%. (Due to size constraints, 1' luminaires are supplied with a driver from a different manufacturer than 2' and above luminaires. For details, please consult factory).

0-10V logarithmic eldoLED ECOdrive dimming (DIL)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for logarithmic dimming curve, Fixtures shipped wired for dimming. For on/off functionality, simply cap the dimming leades. Minimum dimming level preset at factory to 1%.

eldoLED ECOdrive DALI dimming (DED)
Luminaires supplied with ECOdrive DALI dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 1%. For "dim to dark" (down to 0.1%), please consult factory.

eldoLED SOLOdrive 0-10V linear dimming (D01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with linear dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

eldoLED SOLOdrive 0-10V logarithmic dimming (DL01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

LUTRON 2-wire dimming (DC2)
Luminaires supplied with Hi-Lume 2-wire dimming driver (120V only) programmed for Constant Current Reduction (CCR). For Pulse Width Modulation (PWM) dimming, please consult factory. Minimum dimming level down to 1%.

LUTRON EcoSystem dimming (DE1/DC5)
Luminaires supplied with Hi-Lume EcoSystem (4 wire, digital link) dimming driver programmed for Constant Current Reduction (CCR). Minimum dimming level down to 1% (DE1) with SoftOn/FadeToBlack or 5% (DC5).

*For control recommendations, please contact driver manufacturer.

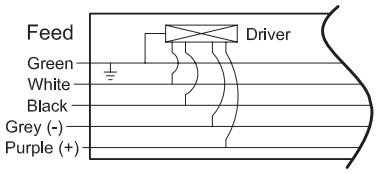
Driver Quantity

Light Engine	Dimming Code	Length															
		1ft	2ft	2ft SG/TB	3ft	4ft	4ft SG/TB	5ft	5ft SG/TB	6ft	6ft SG/TB	7ft	8ft	8ft SG/TB	9ft	10ft	11ft	12ft
1C20	DIM/DIL	N/A	1						2	1	2	1		2		2		1
	D01/DL01/DED																	
	DE1/DC5																	
	DC2															3		2
1C25	DIM/DIL		1						2	1	2	1		2		2		1
	D01/DL01/DED																	
	DE1/DC5																	
	DC2											2				3		2
1C30	DIM/DIL		1						2	1	2	1		2		2		2
	D01/DL01/DED																	
	DE1/DC5																	
	DC2									2		2				3		3
1C35	DIM/DIL	1	1						2	1	2	2	1	2		2		2
	D01/DL01/DED	N/A																
	DE1/DC5																	
	DC2									2			2			3		3
1C40	DIM/DIL		1						2	1	2	2	2				3	
	D01/DL01/DED											1						
	DE1/DC5		N/A															
	DC2																	
1C45	DIM/DIL		1					2	2	1	2		2		3	2	3	
	D01/DL01/DED							1							2			
	DE1/DC5		N/A															
	DC2																	

*For inrush and control current, please refer to the driver manufacturers' spec sheets.

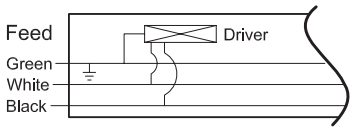
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED Ecodrive (DIL)
DALI logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

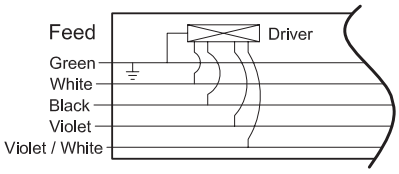


Standard Wiring supplied for all drivers.	Green = Ground White = Neutral Black = Hot
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED D01, DL01	Gray = (-) DALI or 0-10V Dimming Control Purple = (+) DALI or 0-10V Dimming Control
DC2	No additional wires
DE1, DC5	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)

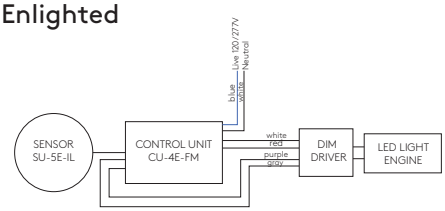


Lutron EcoSystem (DE1)
Lutron 5-Series (DC5)

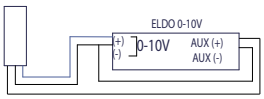


Sensor Wiring Diagrams

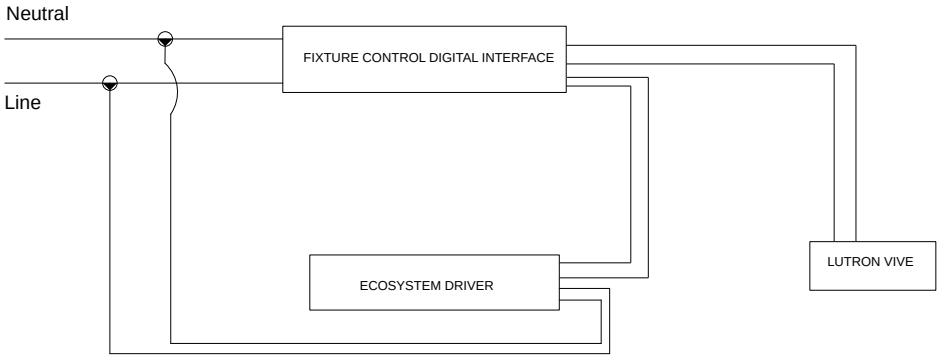
Enlighted



Sensor Switch



Lutron Vive



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage				
Driver	**Light Engine**	**Nominal W/ft**		
		120V	**277V**	**347V**
DIM, DIL, DED, D01, DL01	1C20	4.9	5.3	n/a
	1C25	6.1	6.5	
	1C30	7.3	7.7	
	1C35	8.7	8.9	
	1C40	9.9	10.1	
	1C45	11.1	11.3	
DC2, DE1, DCE, DC5, DC3	1C20	5.5	5.2	n/a
	1C25	6.7	6.3	
	1C30	8.0	7.6	
	1C35	9.3	8.8	
	1C40	10.6	10.0	
	1C45	11.6	11.3	
DIM @347V	1C20	n/a	n/a	5.4
	1C25			6.5
	1C30			7.7
	1C35			8.8
	1C40			10.0
	1C45			11.2
EM	all	6		n/a

Fuse (FS) - Fusing, luminaires supplied with a in-line fuse located on the hot wire for each feed. (supplied with an 8A slow burn fuse).

Damp Location (DL) - Luminaires are suitable for use in damp location(s). Examples of such locations include protected areas under canopies, marquees, roofed porches, and similar locations where the fixture(s) are protected from direct contact with rain, snow, or excessive moisture (such as ocean spray). Interior locations include areas subject to moderate degrees of moisture, such as basements and certain barns and cold storage buildings.

*For Damp Location with sensors, please consult factory.

Separate Switching (SS) - Luminaires available with separately switched 4' (nominal) sections starting at 7' and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

*All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

*To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

*If the project requires different separate switching than outlined above please consult the factory.

*For Separate Switching with sensors, please consult factory.

Emergency Wiring (EC) - Luminaires with (EC) option are compliant to UL 924 listed emergency luminaire. EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

For 1' to 6' nominal luminaires, the entire fixture is wired for operation on emergency circuit.

For 7' and up nominal luminaires, the first 4' nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Emergency Battery (EM) – Luminaires with emergency battery (EM) option are compliant to UL 924 listed emergency luminaire. The EM battery is located integral to fixture and is factory pre-wired. See install instructions for proper wiring.

In the event of an emergency, EM battery will illuminate a 4' section at 12W (constant) for 90 minutes at 25°C. Recharge time is 24 hours.

Direct fixtures are available for emergency battery (EM) use in 4' and ≥6. Due to size constraints, EM is not available in 5' fixtures.

For individual fixtures, emergency option will illuminate the first 4' section of fixture. For continuous runs, please consult factory to advise on 4' section intended for emergency use. For fixtures >12' or if a different configuration is needed, please consult factory.

Emergency test switch and plate is a non-illuminated 3" blank section located adjacent to the length of fixture wired for emergency.

*Emergency battery option is UNV for use with 120V or 277V and is not available for 347V.

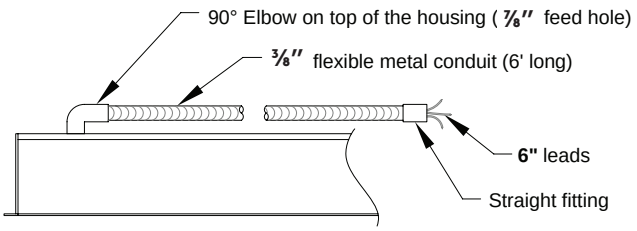
*Please note battery pack requires an unswitched hot.

*For EM with sensors, please consult factory.

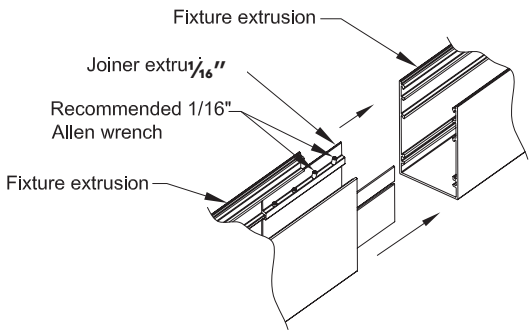
*If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Flex Whip - standard for recessed fixtures



Joiner System - standard for Runs and Configurations



Sensor Ordering Chart		
Quantity	**Sensor**	**Settings***
x Number of Sensors	**E** Enlighted SU-5E-IL **S** Sensor Switch MSD EZ **V** Lutron Vive DFCSJ	**1** Daylight **2** Occupancy/Vacancy **3** Daylight/Occupancy/Vacancy * Settings not available with Enlighted

Enlighted SU-5E-IL (E)
Enlighted Micro Sensor SU-5E-IL (Independent Lighting) provided as standard with an Enlighted CU-4E-FM Fixture Mount Control Unit integral to fixture. If SU-5E-CL (Connected Lighting) or SU-5E-IoT (Internet of Things) is desired, please contact factory. Occupancy/vacancy, thermal, daylight sensing plus Tunable White, Room & Zone control, Internet of Things (IoT) data collection and reporting control. For full details, please see SU-5E-(IoT/CL/IL) spec sheet on the Enlighted website. Must be paired with a 0-10V driver with auxiliary (DIM driver selection). Commissioning by Enlighted.

*Sensor can control up to 5 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Sensor Switch MSD EZ (S)
Occupancy/vacancy and daylight harvesting. For full functionality and programming options, select settings option 3. If a different settings option is selected, other settings may be unavailable. For full details, please see MSD EZ spec sheets on the Sensor Switch website. Must be paired with DIM driver selection. Manual control of dimming not available with MSD EZ sensor.

*Sensor can control up to 30 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Lutron Vive DFCSJ (V)
The DFCSJ-OEM-OCC provides the capabilities of daylight harvesting and occupancy/vacancy sensing. When integrated with the DFC-OEM-DBI (Fixture Contril Digital Link Interface), the sensor is wirelessly compatible with the DE1 Lutron EcoSystem driver. Commissioning bt certified Lutron technician.

*Vive DFCSJ sensor can control up to a maximum of five (5) drivers per sensor. Please refer to driver chart on page 7. Multiple sensors may be required for longer lengths.

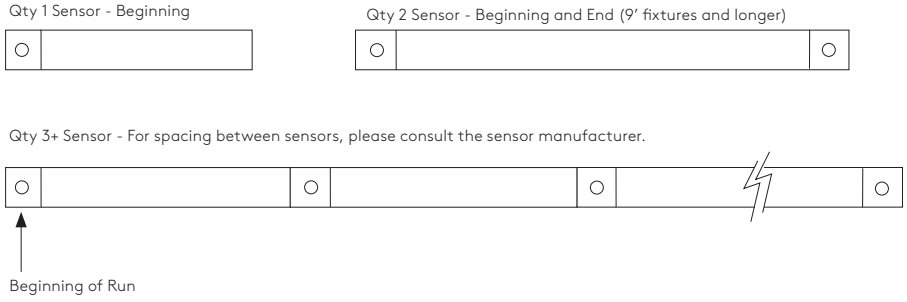
	Occupancy	**Vacancy**	**Daylight Harvesting**	**Driver Compatibility**
Enlighted SU-5E-IL (E)	√	√	√	DIM
Sensor Switch MSD EZ (S)	√	√	√	DIM
Lutron Vive DFCSJ (V)	√	√	√	DE1

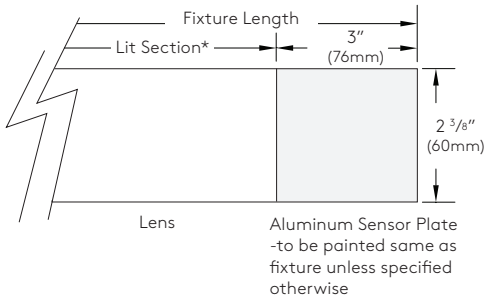
Please contact controls manufacturer for details prior to specifying.

Factory Presets - Sensors come from the sensor manufacturer with factory presets for each of the settings in above chart. Please see sensor manufacturers' spec sheets for details on presets and re-programming.

Commissioning - Commissioning of sensors and installation by others. Contact sensor manufacturer for details and costs associated with commissioning the system prior to specification of sensors.

Standard Sensor Placement - for other placement options, please consult factory. For functionality and limitations, please see sensor details above.





*Lit section will be the fixture length minus 3" for sensor plate.

Notes: 1. For spacing between sensors, please consult the sensor manufacturer.
2. Exact sensor placement and coverage will be defined by approved factory drawing.
3. Sections controlled by sensors may not be symmetrical - consult factory for layout.

Standard Recessed (L60) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

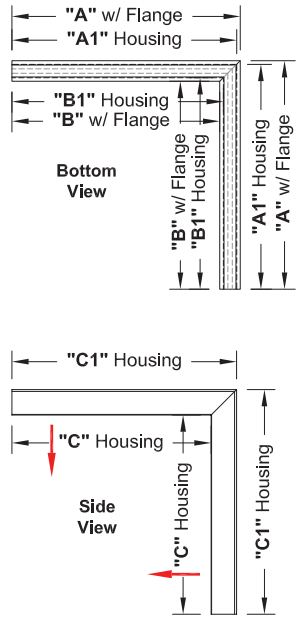
The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

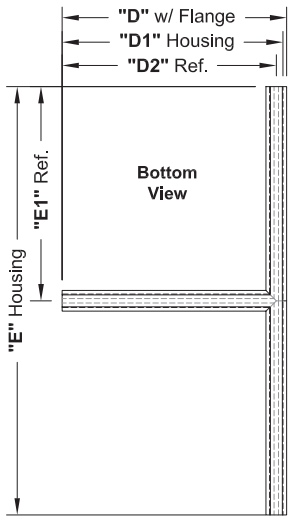
Project Specific Recessed (L60) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

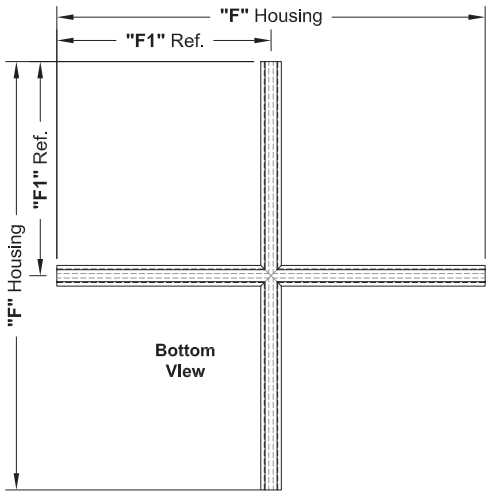
L9 - Lit Horizontal Corner



T9 - Lit "T" Section



X9 - Lit "X" Section



Recessed (L60) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
"A" Housing (Outside)	2' - 1 1/4"	642						
"A1" Housing (Inside)	1' - 10 15/16"	582						
"B" Housing (Outside)			1' - 11 1/2"	597				
"B1" Housing (Inside)			2' - 3 1/16"	688				
"C" Housing (Inside)					2' - 1 1/4"	642		
* "C1" Ref.					2' - 1/8"	612		
"D" Housing					4' - 3/16"	1224		
* "D1" Ref.					2' - 1/8"	612		
"E" Housing							4' - 3/16"	1224
* "E1" Ref.							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Standard Recessed (L6R1/2) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example, leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example, 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

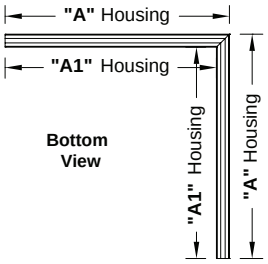
*For sensors in configurations, please consult factory.

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

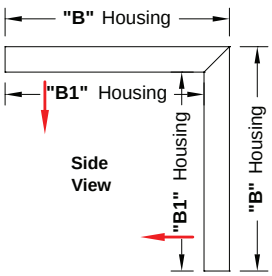
Project Specific Recessed (L6R1/2) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

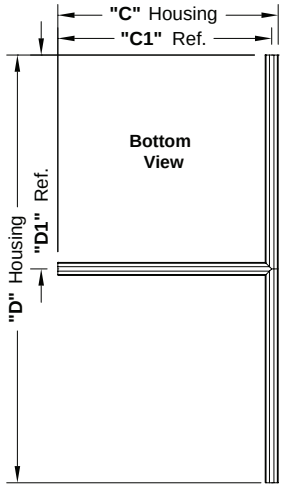
L9 - Lit Horizontal corner



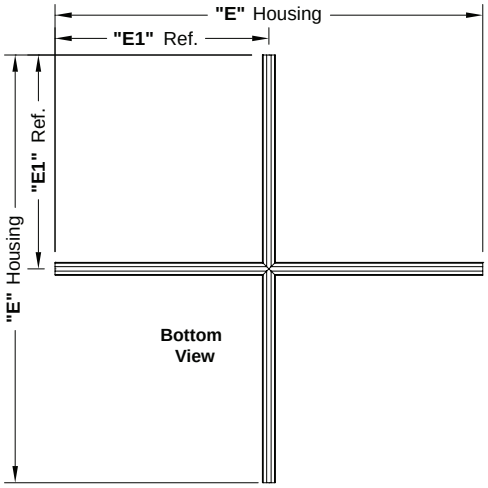
V9 - Lit Inside corner



T9 - Lit "T" section



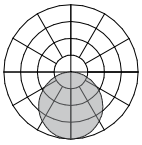
X9 - Lit "X" section



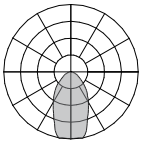
Recessed (L6R1/R2) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
"A" w/Flange (Outside)	2' - 1 3/4"	654						
"A1" Housing (Outside)	2' - 1 1/4"	642						
"B" w/Flange (Inside)	1' - 10 7/16"	570						
"B1" Housing (Inside)	1' - 10 15/16"	582						
"C" Housing (Inside)			2' - 3 1/16"	688				
"C1" Housing (Outside)			1' - 11 1/2"	597				
"D" w/Flange					2' - 1 3/4"	654		
"D1" Housing					2' - 1 1/4"	642		
* "D2" Ref.					2' - 1/8"	612		
"E" Housing					4' - 3/16"	1224		
* "E1" Ref.					2' - 1/8"	612		
"F" Housing							4' - 3/16"	1224
* "F1" Ref.							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

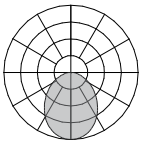
Photometry



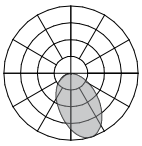
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2804	701	8.8	79



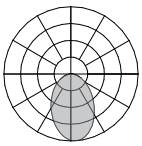
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3251	813	8.8	92



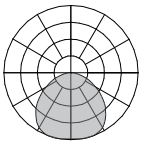
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3002	751	8.8	85



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3032	758	8.8	86



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2807	702	8.8	79



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3926	982	8.8	111

M60 Recessed	
CCT Multiplier	
4000K	1.05
3500K	1.00
3000K	0.96
2700K	0.92
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

Date: _____ Customer: _____

Project: Compton College -VAPA

Type: LT-02 SERIES Qty: _____

selux

M60
LED Recessed

Order Code: _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

Series

L60	L6R1	L6R2
Multi-Mount Form	Continuous Flange (Flanged Endcaps)	Continuous Flange (Flangeless Endcaps)

Light Engine

1C45[1,2,3]	1C40[1,2,3]	1C35[1]	1C30[1,2]	1C25[1,2]	1C20[1,2]
80CRI-1018lm 90CRI-855lm 11.1W per foot	80CRI-954lm 90CRI-802lm 9.9W per foot	80CRI-834lm 90CRI-701lm 8.7W per foot	80CRI-746lm 90CRI-627lm 7.3W per foot	80CRI-594lm 90CRI-500lm 6.1W per foot	80CRI-494lm 90CRI-415lm 4.9W per foot

[1] Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2.
[2] Available starting at 2' and up
[3] Not available with Lutron

CCT

927	930	935	940	827[4]	830[4]	835[4]	840[4]	RGBW
2700K 90+ CRI	3000K 90+ CRI	3500K 90+ CRI	4000K 90+ CRI	2700K 80+ CRI	3000K 80+ CRI	3500K 80+ CRI	4000K 80+ CRI	(consult factory)

[4] Consult factory for lead times.

Shielding

LW	MI	NB	A2	A5	BW
LED Optimized White Lens	Clear Lens with Microprism	LMO Symmetric with Satine Lens	LMO Asymmetric 20° Wall Washer with Satine Lens	LMO Asymmetric 5° Wall Grazer with Satine Lens	LMO Batwing with Satine Lens

Mounting L60 or Mounting L6R1 or L6R2

SF1	SF2	SF3	SG	DC
Spackle Flange (½" Drywall)	Spackle Flange (⅝" Drywall)	Spackle Flange (After Drywall)	Slot Grid (9/16") (Wire Suspension or ¼"-20 stud)	Decoustic Ceiling (up to 2" thick)

TB[5]	TBS[5]	PMT[5]	RC[6]	TS	PM
T-Bar Length with suspension clips	T-Bar Length with 1" ¼"-20 Stud	T-Bar Length Perimeter Mount	Rotating Crossbar (Ceilings ¼" to 2" thick)	1" ¼"-20 Stud	Perimeter Mount

[5] L6R1 only
[6] Consult factory for lengths under 2'

Nominal Fixture Length

01*	02[7]	03	04[7]	05[7]	06[7]	07	08[7]	XX
1 ft.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.	7 ft.	8 ft.	Runs (over 8') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 09=09' nominal)

[7] Length intended to fit centered between the grid for SG, TB, TBS, PMT mountings

**1' fixture only available with 1C35 light engine.*
Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.

Finish

WH	BL	SV	SP
White	Semi-Matte Black	Silver	Specify Premium Color

** Custom colors are available, please consult factory*

Voltage

1	2	U	3[8]
120V	277V	120V through 277V 50/60hz capable	347V (consult factory)

[8] 347V not available with EM integral battery option

Driver

DIM[9]	DIL[9,10]	DED[9,10]	D01[9,10]	DL01[9,10]	DC2[9,10,11]	DE1[9,10]	DC5	DC3
0-10V 1% (Linear)	eldoLED 1% ECOdrive 0-10V (Logarithmic)	eldoLED 1% ECOdrive DALI (Logarithmic)	eldoLED 0.1% SOLOdrive 0-10V (Linear)	eldoLED 0.1% SOLOdrive 0-10V (Logarithmic)	Lutron 1% 2-Wire	Lutron 1% EcoSystem	Lutron 5% 5-Series (consult factory)	Lutron 1% 3-Wire (consult factory)

[9] See page 7 for full details
[10] Not available for 1' length
[11] 120V only

Fixture Options

DL	FS	SS[12]	CCEA
Damp Location Rated	In-line Fuse	Separate Switching	CCEA approved

[12] See page 10 for details

Sensor Options

xE[13,14]	xS1[13,14]	xS2[13,14]	xS3[13,14]	xSN	xV
Enlighted	Sensor Switch Daylight	Sensor Switch Occ/Vac/ Daylight	Sensor Switch Occ/Vac/ Daylight	nLight Enabled (consult factory)	Lutron Vive (consult factory)

Replace "x" with quantity

[13] Minimum fixture length 2'. See page 10 for full details and restrictions
[14] Requires DIM driver (0-10V)

Emergency Options

EC[15,16]	EMR	EM[15,16,17]
Emergency Circuit Wiring	Remote Micro Inverter (consult factory)	Integral EM Battery Pack (Non-IC rated)

[15] See page 8 for full details and restrictions
[16] For EM with sensors please consult factory
[17] 4' available with DIM driver only. ≥6' available with all driver options.

Configuration Options

L9[1]	V9	T9	X9
Lit Horizontal 90° Corner	Lit Inverted 90° Corner	Lit "T" section	Lit "X" section

*See pages 12-13 for full details and restrictions

All options indicated with the green truck symbol are available with 4-week ship time. Mixed orders will defer to the longest lead time.

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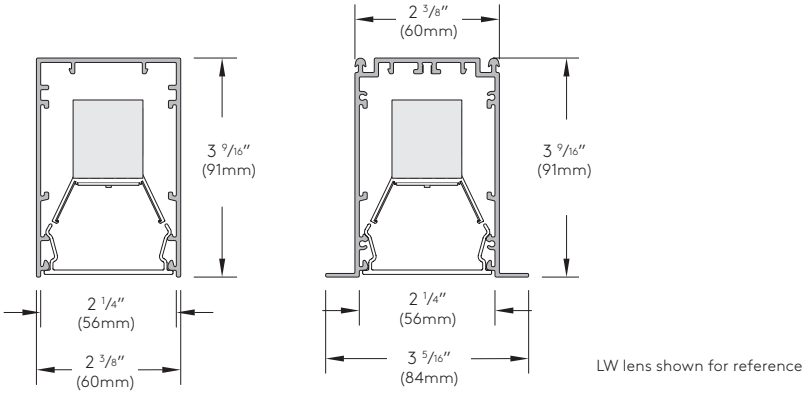

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 8') or Runs.

Flange (L6R1 or L6R2 Series)- 9/16" (14mm) wide flange runs full lengths of both sides and is part of the main extruded body. Specify continuous flange (L6R1) or flush (L6R2) end cap. L6R2 does not work in T-Bar ceiling.

Geartray - Low copper 6063-T6 extruded aluminum profile.

Shielding - Extruded, impact resistant acrylic snap in lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - Spackle-in (drywall), Slot grid, Decoustic, T-bar grid, Perimeter, Rotating Crossbar and Threaded Stud Mountings (see pages 3 through 6 for details).

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately 1/4" increments starting at the nominal 8' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with you requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaires.

L60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied L60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 10 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 14 for details.

CCT - Available in 2700K, 3000K, 3500K and 4000K, tolerance within a 3-step MacAdam ellipse.

CRI - 90+ and 80+ CRI. Consult factory for lead times of 80 CRI.

All Drivers - High efficiency, constant current, soft start, Electronic Class 2 with a PFC>0.90. For more detailed information on the available drivers please see page 7.

Sensors - Selux offers a variety of integral sensor options. For details and specifications, please refer to page 11.

Emergency - There are multiple emergency options available - Emergency Circuit, Remote Micro Inverter, and Integral EM Battery Pack. All options compliant with UL 924 listed emergency luminaire. Please consult factory for use of sensors with emergency options. For more details on EC and EM options, see page 10.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for maximum ambient temperature of 35°C (95°F) for all drivers.

Luminaires are suitable for minimum ambient temperatures of -40°C (-40°F) for DIM, DIL, DED, D01, and DL01 drivers; 0°C (32°F) for DC2 and DE1 drivers.

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

Warranty:

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

Certifications and Compliance:

NRTL - For Dry and Damp location
(I.E. cULus; cCSAus)
ARRA Compliant
RoHS Compliant
*EM option is non IC-rated

Received
By PCM3 at 12:54 pm, April 27, 2023

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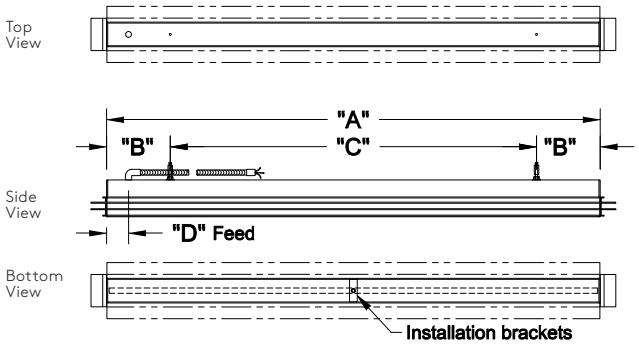
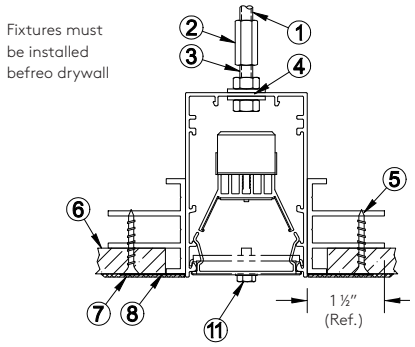
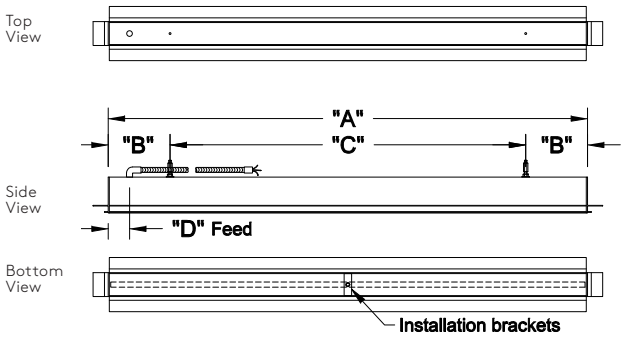
½" Spackle Flange Mounting (SF1)



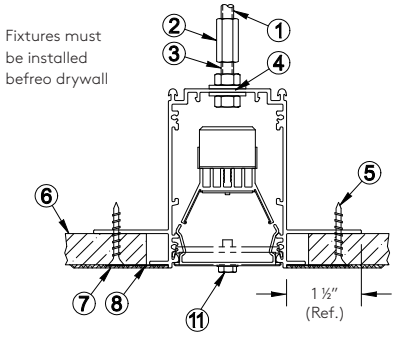
½" Spackle Flange Mounting (SF1)



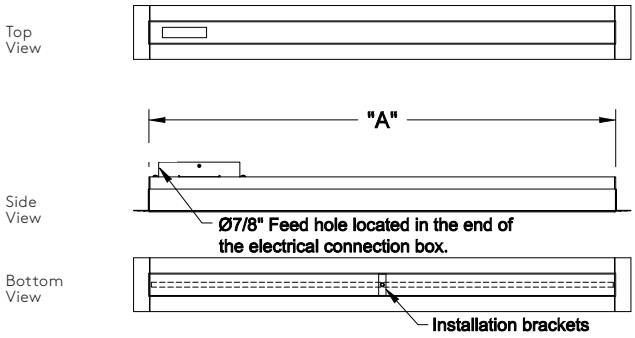
⅝" Spackle Flange Mounting (SF2)



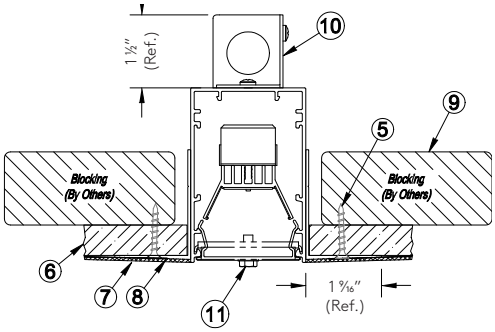
⅝" Spackle Flange Mounting (SF2)



After Drywall Flange Mounting (SF3)



After Drywall Flange Mounting (SF3)

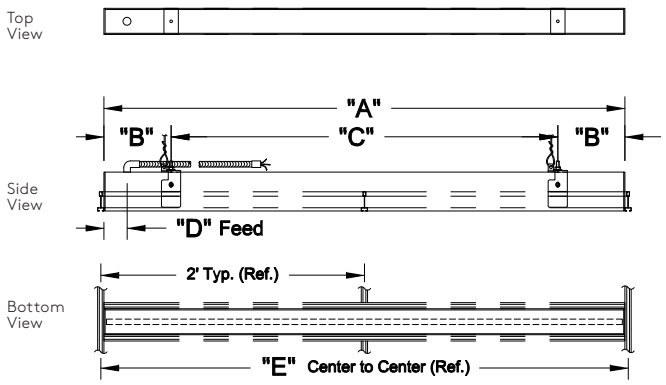


Spackle Flange Mounting (SF1, SF2 and SF3) - Dimensions								
Nominal Length	**"A" O.A.L. w/o Flange**		**"B" End Suspensions**		*** "C" (Ref.) Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1 ft.)	1' - ¼"	311	0' - 1 ⅝"	41	0' - 9"	229	0' - 4 ⅛"	105
02 (2 ft.)	2' - ¼"	616	0' -1 ⅝"	41	1' - 9"	533	0' - 4 ⅛"	105
03 (3 ft.)	3' - ¼"	921	0' -6 ⅛"	156	2' - 0"	609	0' - 2 ⅛"	54
04 (4 ft.)	4' - ¼"	1226	0' -6 ⅛"	156	3' - 0"	914	0' - 2 ⅛"	54
05 (5 ft.)	5' - ¼"	1530	0' -6 ⅛"	156	4' - 0"	1219	0' - 2 ⅛"	54
06 (6 ft.)	6' - ¼"	1835	0' -6 ⅛"	156	5' - 0"	1524	0' - 2 ⅛"	54
07 (7 ft.)	7' - ¼"	2140	0' -6 ⅛"	156	6' - 0"	1829	0' - 2 ⅛"	54
08 (8 ft.)	8' - ¼"	2445	0' -6 ⅛"	156	7' - 0"	2134	0' - 2 ⅛"	54

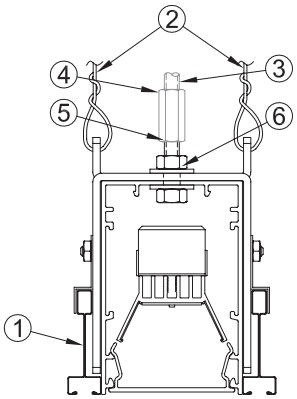
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to struture (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. Drywall/Drywall screw (Ref.)
6. Drywall/Drywall (Ref.)
7. ⅛" Plaster skimcoat (Ref.)
8. Drywall/Drywall tape (Ref.)
9. Blocking to secure fixture (by others)
10. Electrical connection box, removable side cover for electrical connection pre-installation, once installed the wiring is accessible from below the ceiling through the luminaire.
11. Luminaires ship with the brackets pre-installed.
    - The brackets cannot be removed until the fixture is completely installed and secured through the spackle flange.
    - Once the brackets are removed, the lens can be installed.

Slot Grid Mounting (SG)



9⁄16" Slot Grid Mounting (SG)
(Wire Suspension or ¼"-20 Stud)

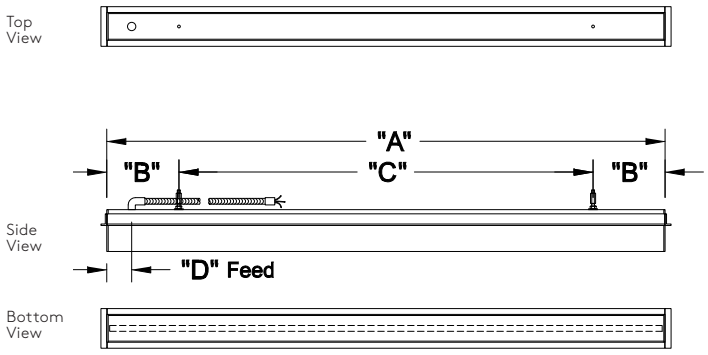


1. 9⁄16" Slot grid (shown as Ref.)
2. Support wire to structure (supplied and installed by others).
3. ¼"-20 Threaded rod to structure (supplied and installed by others).
4. ¼"-20 Coupler hardware (supplied and installed by others).
5. 1" ¼"-20 Stud (by Selux).
6. Ø5⁄16" (Ø7mm) mounting hole.

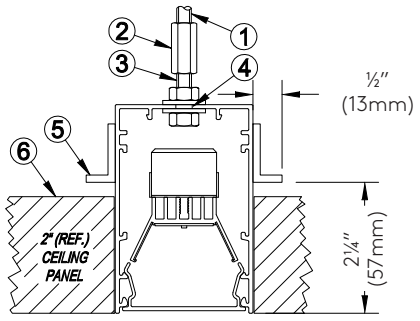
Slot Grid Mounting (SG) - Dimensions									
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" (Ref.) Mid. Suspension		"D" Feed Location		"E" Grid Spacing
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	
02 (2 ft.)	1' - 11 5⁄16"	592	0' -1 5⁄8"	41	1' - 5 3⁄16"	437	0' - 1 1⁄8"	29	2' Center to Center
04 (4 ft.)	3' - 11 5⁄16"	1202	0' - 6 1⁄8"	156	2' - 11 3⁄16"	894	0' - 2 1⁄8"	54	4' Center to Center
05 (5 ft.)	4' - 11 5⁄16"	1507	0' - 6 1⁄8"	156	3' - 11 3⁄16"	1199	0' - 2 1⁄8"	54	5' Center to Center
06 (6 ft.)	5' - 11 5⁄16"	1811	0' - 6 1⁄8"	156	5' - 11 3⁄16"	1504	0' - 2 1⁄8"	54	6' Center to Center
08 (8 ft.)	7' - 11 5⁄16"	2421	0' - 6 1⁄8"	156	6' - 11 3⁄16"	2113	0' - 2 1⁄8"	54	8' Center to Center

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

Decoustic Mounting (DC)



Decoustic Mounting (DC)
(Panels up to 2" thick)

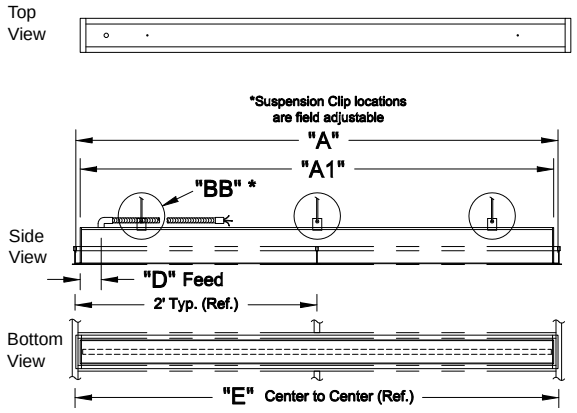


Decoustic Mounting (DC) - Dimensions								
Nominal Length	"A" Housing Length		"B" End Suspensions		* "C" (Ref.) Mid. Suspension		"D" Feed Location	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
01 (1 ft.)	1' - ¼"	311	1 5⁄8"	41	0' - 9"	229	0' - 4 1⁄8"	105
02 (2 ft.)	2' - ¼"	616	1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105
03 (3 ft.)	3' - ¼"	921	6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54
04 (4 ft.)	4' - ¼"	1226	6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54
05 (5 ft.)	5' - ¼"	1530	6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54
06 (6 ft.)	6' - ¼"	1835	6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54
07 (7 ft.)	7' - ¼"	2140	6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54
08 (8 ft.)	8' - ¼"	2445	6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54

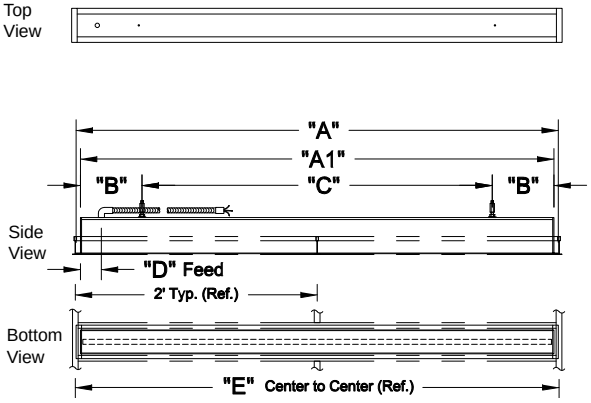
*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

1. ¼"-20 Threaded rod to structure (supplied and installed by others).
2. ¼"-20 Coupler hardware (supplied and installed by others).
3. 1" ¼"-20 Stud (by Selux).
4. Ø5⁄16" (Ø7mm) mounting hole.
5. ½" wide aluminum angle runs the entire length of fixture to block view into plenum area from below fixture.
6. Suitable for Decoustic® ceiling panel installations with panels up to 2" thick (supplied and installed by others). Other ceiling systems possible, please consult factory. Decoustic® is a registered trademark of Decoustics Ltd. Corporation.

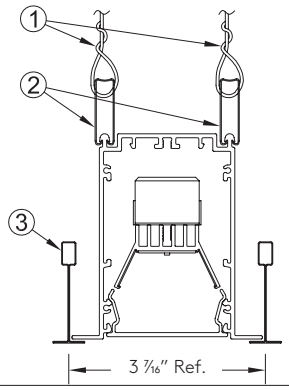
T-Bar Mounting (TB)



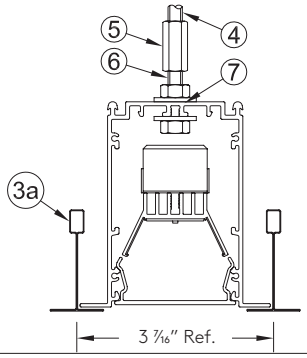
T-Bar with Stud Mounting (TBS)



T-Bar with Suspension Clips (TB)
(9/16" or 15/16" grid)



T-Bar with 1/4"-20 Stud (TBS)
(9/16" or 15/16" grid)



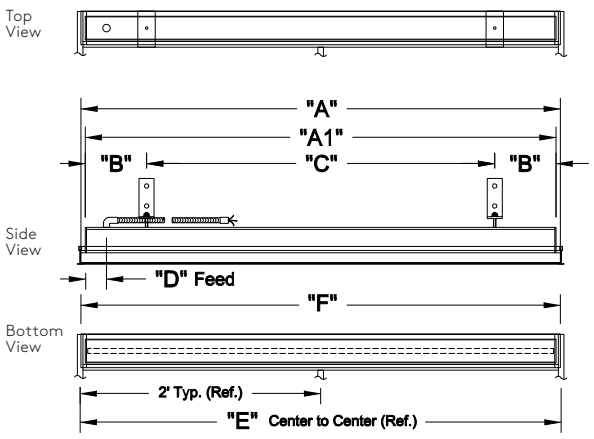
1. Support wire to structure (supplied and installed by others).
2. Spring steel suspension clips located approximately every 4 ft. (supplied by Selux).
3. 9/16" T-bar grid (shown as Ref.)
3a. 15/16" T-bar grid (shown as Ref.)
4. 1/4"-20 Threaded rod to structure (supplied and installed by others).
5. 1/4"-20 Coupler hardware (supplied and installed by others).
6. 1" 1/4"-20 Stud (by Selux).
7. Ø5/16" (Ø7mm) mounting hole.

T-Bar (TB and TBS) and Perimeter Mount (PMT) - Dimensions														
Nominal Length	**"A" O.A.L. with Flange**		**"A1" O.A.L. without Flange**		**"B" End Suspensions**		**"BB" (TB mtg.) Suspension Clips**	**** "C" (Ref.) Mid. Suspension**		**"D" Feed Location**		**"E" Grid Spacing**	**"F" Wall Angle**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Quantity**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**		**Feet/Inch**	**MM**
***02 (2 ft.)**	1' - 11 13/16"	605	1' - 11"	583	0' - 1 5/8"	41	4x	1' - 4 3/4"	425	0' - 1 1/8"	29	2' Center to Center	1' - 10 3/4"	577
***04 (4 ft.)**	3' - 11 13/16"	1215	3' - 11"	1193	0' - 6 5/8"	156	6x	2' - 10 3/4"	882	0' - 2 1/8"	54	4' Center to Center	3' - 10 3/4"	1187
***05 (5 ft.)**	4' - 11 13/16"	1519	4' - 11"	1497	0' - 6 5/8"	156	6x	3' - 10 3/4"	1187	0' - 2 1/8"	54	5' Center to Center	4' - 10 3/4"	1491
***06 (6 ft.)**	5' - 11 13/16"	1825	5' - 11"	1803	0' - 6 5/8"	156	6x	4' - 10 3/4"	1492	0' - 2 1/8"	54	6' Center to Center	5' - 10 3/4"	1787
***08 (8 ft.)**	7' - 11 13/16"	2434	7' - 11"	2412	0' - 6 5/8"	156	8x	6' - 10 3/4"	2101	0' - 2 1/8"	54	8' Center to Center	7' - 10 3/4"	2406

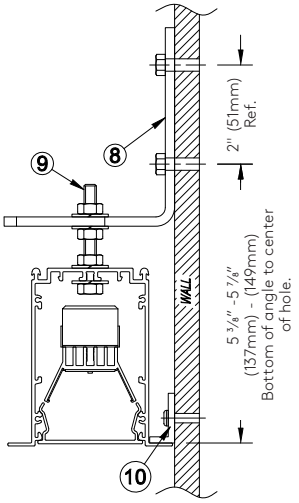
*For other lengths consult factory

**Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Perimeter Mounting T-Bar Length (PMT)

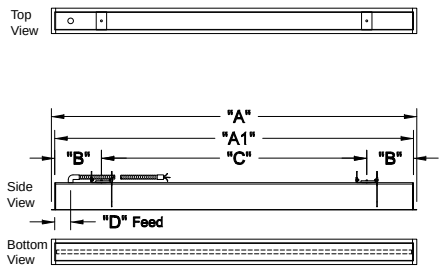


Perimeter Mount T-Bar Length (PMT)
(Recessed Wall Mounting)

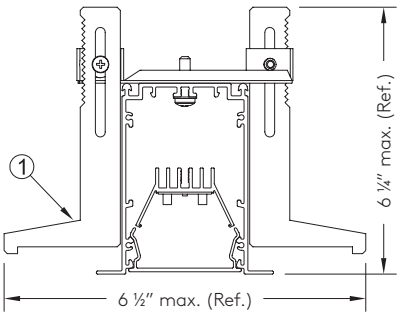


8. Steel Wall Bracket with provision for 1/4"-20 fasteners (hardware to code by others).
9. 2" 1/4"-20 Stud (by Selux).
10. 1/2" x 1" aluminum wall angle allows a gap between flange and wall to create shadow line allowing for uneveness of wall. Provision for #10 screws supplied approximately every 2 ft. (hardware to code by others).

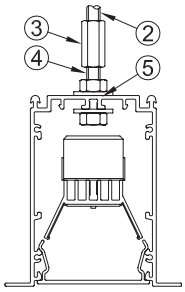
Rotating Crossbar Mounting (RC)



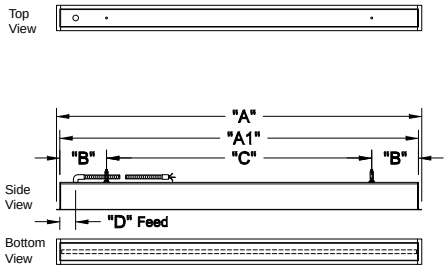
Rotating Crossbars (RC)
(¼" to 2" thick ceiling)



¼-20 Threaded Stud (TS)
(1" Threaded Stud)



¼"-20 Threaded Stud Mounting (TS)



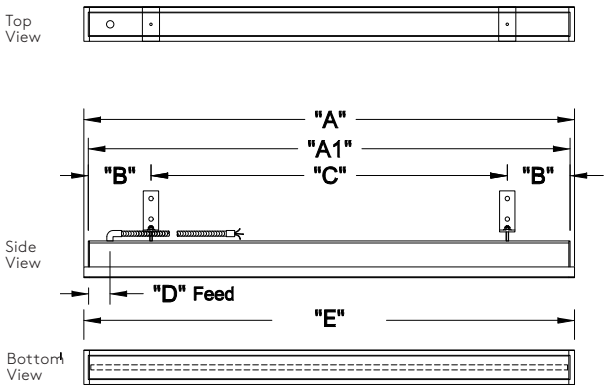
1. Rotating Crossbar intended for inaccessible ceilings, adjustable for ceiling thickness of ¼" to 2".
2. ¼"-20 Threaded rod to structure (supplied and installed by others).
3. ¼"-20 Coupler hardware (supplied and installed by others).
4. 1" ¼"-20 Stud (by Selux).
5. Ø5⁄16" (Ø7mm) mounting hole.

Rotating Crossbar (RC), Threaded Stud (TS), and Perimeter Mountings (PM) - Dimensions												
Nominal Length	"A" O.A.L. with Flange		"A1" O.A.L. without Flange		"B" End Suspensions		** "C" (Ref.) Mid. Suspension		"D" Feed Location		"E" Wall Angle	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
*01 (1 ft.)	1' - 1 1⁄8"	333	1' - ¼"	311	0' - 1 5⁄8"	41	0' - 9"	229	0' - 4 1⁄8"	105	1' - 0"	305
02 (2 ft.)	2' - 1 1⁄8"	638	2' - ¼"	616	0' - 1 5⁄8"	41	1' - 9"	533	0' - 4 1⁄8"	105	2' - 0"	610
03 (3 ft.)	3' - 1 1⁄8"	942	3' - ¼"	921	0' - 6 1⁄8"	156	2' - 0"	609	0' - 2 1⁄8"	54	3' - 0"	914
04 (4 ft.)	4' - 1 1⁄8"	1247	4' - ¼"	1226	0' - 6 1⁄8"	156	3' - 0"	914	0' - 2 1⁄8"	54	4' - 0"	1219
05 (5 ft.)	5' - 1 1⁄8"	1552	5' - ¼"	1530	0' - 6 1⁄8"	156	4' - 0"	1219	0' - 2 1⁄8"	54	5' - 0"	1524
06 (6 ft.)	6' - 1 1⁄8"	1857	6' - ¼"	1835	0' - 6 1⁄8"	156	5' - 0"	1524	0' - 2 1⁄8"	54	6' - 0"	1829
07 (7 ft.)	7' - 1 1⁄8"	2162	7' - ¼"	2140	0' - 6 1⁄8"	156	6' - 0"	1829	0' - 2 1⁄8"	54	7' - 0"	2134
08 (8 ft.)	8' - 1 1⁄8"	2466	8' - ¼"	2445	0' - 6 1⁄8"	156	7' - 0"	2134	0' - 2 1⁄8"	54	8' - 0"	2438

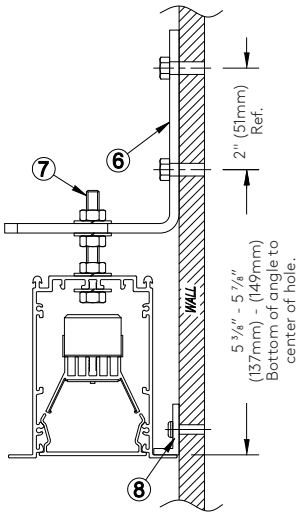
*RC mounting, consult factory for lengths under 2'

**Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

Perimeter Mounting (PM)



Perimeter Mount (PM)
(Recessed Wall Mounting)



6. Steel Wall Bracket with provision for ¼"-20 fasteners (hardware to code by others).
7. 2" ¼"-20 Stud (by Selux).
8. ½" x 1" aluminum wall angle allows a gap between flange and wall to create shadow line allowing for uneveness of wall. Provision for #10 screws supplied approximately every 2 feet (hardware to code by others).

Drivers:

0-10V linear dimming (DIM)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 1%. (Due to size constraints, 1' luminaires are supplied with a driver from a different manufacturer than 2' and above luminaires. For details, please consult factory).

0-10V logarithmic eldoLED ECOdrive dimming (DIL)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for logarithmic dimming curve, Fixtures shipped wired for dimming. For on/off functionality, simply cap the dimming leades. Minimum dimming level preset at factory to 1%.

eldoLED ECOdrive DALI dimming (DED)
Luminaires supplied with ECOdrive DALI dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 1%. For "dim to dark" (down to 0.1%), please consult factory.

eldoLED SOLOdrive 0-10V linear dimming (D01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with linear dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

eldoLED SOLOdrive 0-10V logarithmic dimming (DL01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

LUTRON 2-wire dimming (DC2)
Luminaires supplied with Hi-Lume 2-wire dimming driver (120V only) programmed for Constant Current Reduction (CCR). For Pulse Width Modulation (PWM) dimming, please consult factory. Minimum dimming level down to 1%.

LUTRON EcoSystem dimming (DE1/DC5)
Luminaires supplied with Hi-Lume EcoSystem (4 wire, digital link) dimming driver programmed for Constant Current Reduction (CCR). Minimum dimming level down to 1% (DE1) with SoftOn/FadeToBlack or 5% (DC5).

*For control recommendations, please contact driver manufacturer.

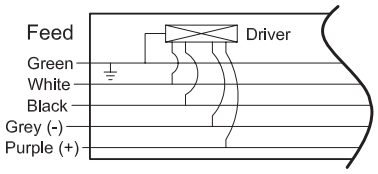
Driver Quantity

Light Engine	Dimming Code	Length															
		1ft	2ft	2ft SG/TB	3ft	4ft	4ft SG/TB	5ft	5ft SG/TB	6ft	6ft SG/TB	7ft	8ft	8ft SG/TB	9ft	10ft	11ft	12ft
1C20	DIM/DIL	N/A	1						2	1	2	1		2		2		1
	D01/DL01/DED																	
	DE1/DC5																	
	DC2															3		2
1C25	DIM/DIL		1						2	1	2	1		2		2		1
	D01/DL01/DED																	
	DE1/DC5																	
	DC2											2				3		2
1C30	DIM/DIL		1						2	1	2	1		2		2		2
	D01/DL01/DED																	
	DE1/DC5																	
	DC2									2		2				3		3
1C35	DIM/DIL	1	1						2	1	2	2	1	2		2		2
	D01/DL01/DED	N/A																
	DE1/DC5																	
	DC2									2			2			3		3
1C40	DIM/DIL		1						2	1	2	2	2				3	
	D01/DL01/DED											1						
	DE1/DC5		N/A															
	DC2																	
1C45	DIM/DIL		1					2	2	1	2		2		3	2	3	
	D01/DL01/DED							1							2			
	DE1/DC5		N/A															
	DC2																	

*For inrush and control current, please refer to the driver manufacturers' spec sheets.

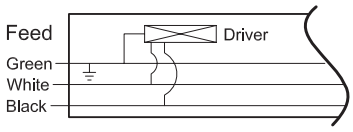
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED Ecodrive (DIL)
DALI logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

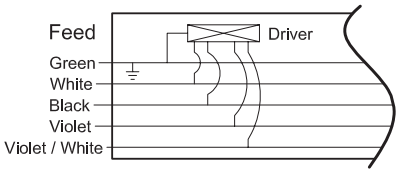


Standard Wiring supplied for all drivers.	Green = Ground White = Neutral Black = Hot
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED D01, DL01	Gray = (-) DALI or 0-10V Dimming Control Purple = (+) DALI or 0-10V Dimming Control
DC2	No additional wires
DE1, DC5	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)

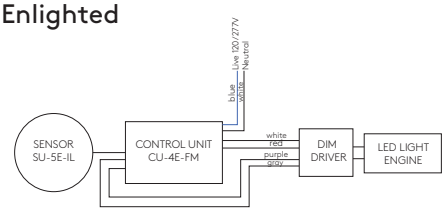


Lutron EcoSystem (DE1)
Lutron 5-Series (DC5)

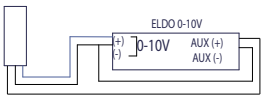


Sensor Wiring Diagrams

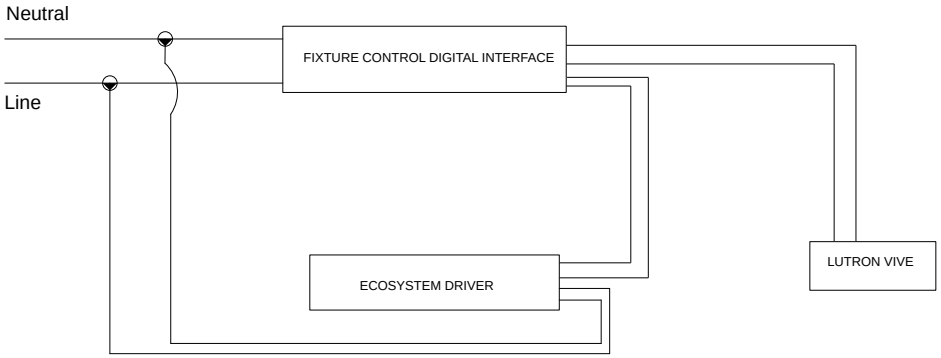
Enlighted



Sensor Switch



Lutron Vive



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage				
Driver	**Light Engine**	**Nominal W/ft**		
		120V	**277V**	**347V**
DIM, DIL, DED, D01, DL01	1C20	4.9	5.3	n/a
	1C25	6.1	6.5	
	1C30	7.3	7.7	
	1C35	8.7	8.9	
	1C40	9.9	10.1	
	1C45	11.1	11.3	
DC2, DE1, DCE, DC5, DC3	1C20	5.5	5.2	n/a
	1C25	6.7	6.3	
	1C30	8.0	7.6	
	1C35	9.3	8.8	
	1C40	10.6	10.0	
	1C45	11.6	11.3	
DIM @347V	1C20	n/a	n/a	5.4
	1C25			6.5
	1C30			7.7
	1C35			8.8
	1C40			10.0
	1C45			11.2
EM	all	6		n/a

Fuse (FS) - Fusing, luminaires supplied with a in-line fuse located on the hot wire for each feed. (supplied with an 8A slow burn fuse).

Damp Location (DL) - Luminaires are suitable for use in damp location(s). Examples of such locations include protected areas under canopies, marquees, roofed porches, and similar locations where the fixture(s) are protected from direct contact with rain, snow, or excessive moisture (such as ocean spray). Interior locations include areas subject to moderate degrees of moisture, such as basements and certain barns and cold storage buildings.

*For Damp Location with sensors, please consult factory.

Separate Switching (SS) - Luminaires available with separately switched 4' (nominal) sections starting at 7' and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

*All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

*To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

*If the project requires different separate switching than outlined above please consult the factory.

*For Separate Switching with sensors, please consult factory.

Emergency Wiring (EC) - Luminaires with (EC) option are compliant to UL 924 listed emergency luminaire. EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

For 1' to 6' nominal luminaires, the entire fixture is wired for operation on emergency circuit.

For 7' and up nominal luminaires, the first 4' nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Emergency Battery (EM) – Luminaires with emergency battery (EM) option are compliant to UL 924 listed emergency luminaire. The EM battery is located integral to fixture and is factory pre-wired. See install instructions for proper wiring.

In the event of an emergency, EM battery will illuminate a 4' section at 12W (constant) for 90 minutes at 25°C. Recharge time is 24 hours.

Direct fixtures are available for emergency battery (EM) use in 4' and ≥6. Due to size constraints, EM is not available in 5' fixtures.

For individual fixtures, emergency option will illuminate the first 4' section of fixture. For continuous runs, please consult factory to advise on 4' section intended for emergency use. For fixtures >12' or if a different configuration is needed, please consult factory.

Emergency test switch and plate is a non-illuminated 3" blank section located adjacent to the length of fixture wired for emergency.

*Emergency battery option is UNV for use with 120V or 277V and is not available for 347V.

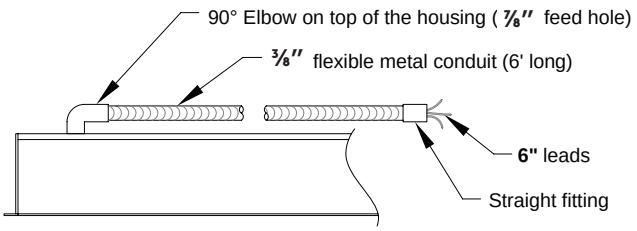
*Please note battery pack requires an unswitched hot.

*For EM with sensors, please consult factory.

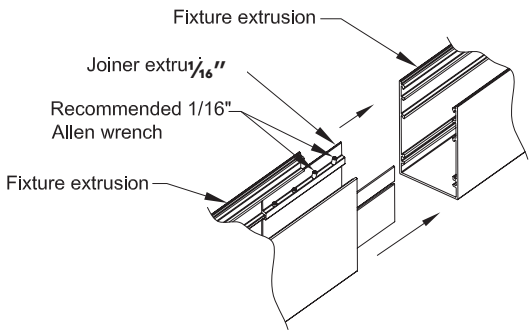
*If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Flex Whip - standard for recessed fixtures



Joiner System - standard for Runs and Configurations



Sensor Ordering Chart		
Quantity	**Sensor**	**Settings***
x Number of Sensors	**E** Enlighted SU-5E-IL **S** Sensor Switch MSD EZ **V** Lutron Vive DFCSJ	**1** Daylight **2** Occupancy/Vacancy **3** Daylight/Occupancy/Vacancy * Settings not available with Enlighted

Enlighted SU-5E-IL (E)
Enlighted Micro Sensor SU-5E-IL (Independent Lighting) provided as standard with an Enlighted CU-4E-FM Fixture Mount Control Unit integral to fixture. If SU-5E-CL (Connected Lighting) or SU-5E-IoT (Internet of Things) is desired, please contact factory. Occupancy/vacancy, thermal, daylight sensing plus Tunable White, Room & Zone control, Internet of Things (IoT) data collection and reporting control. For full details, please see SU-5E-(IoT/CL/IL) spec sheet on the Enlighted website. Must be paired with a 0-10V driver with auxiliary (DIM driver selection). Commissioning by Enlighted.

*Sensor can control up to 5 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Sensor Switch MSD EZ (S)
Occupancy/vacancy and daylight harvesting. For full functionality and programming options, select settings option 3. If a different settings option is selected, other settings may be unavailable. For full details, please see MSD EZ spec sheets on the Sensor Switch website. Must be paired with DIM driver selection. Manual control of dimming not available with MSD EZ sensor.

*Sensor can control up to 30 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Lutron Vive DFCSJ (V)
The DFCSJ-OEM-OCC provides the capabilities of daylight harvesting and occupancy/vacancy sensing. When integrated with the DFC-OEM-DBI (Fixture Contril Digital Link Interface), the sensor is wirelessly compatible with the DE1 Lutron EcoSystem driver. Commissioning bt certified Lutron technician.

*Vive DFCSJ sensor can control up to a maximum of five (5) drivers per sensor. Please refer to driver chart on page 7. Multiple sensors may be required for longer lengths.

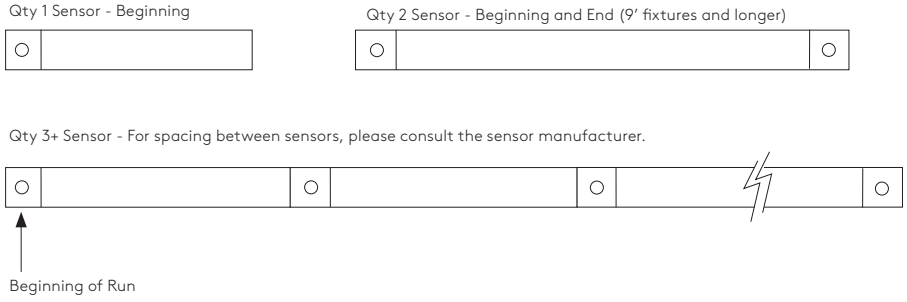
	Occupancy	**Vacancy**	**Daylight Harvesting**	**Driver Compatibility**
Enlighted SU-5E-IL (E)	√	√	√	DIM
Sensor Switch MSD EZ (S)	√	√	√	DIM
Lutron Vive DFCSJ (V)	√	√	√	DE1

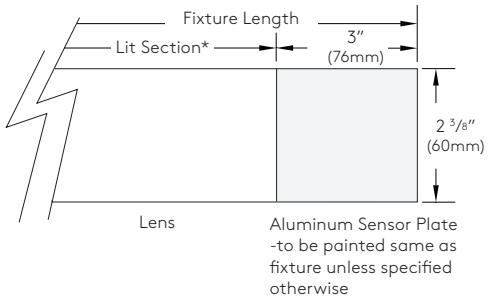
Please contact controls manufacturer for details prior to specifying.

Factory Presets - Sensors come from the sensor manufacturer with factory presets for each of the settings in above chart. Please see sensor manufacturers' spec sheets for details on presets and re-programming.

Commissioning - Commissioning of sensors and installation by others. Contact sensor manufacturer for details and costs associated with commissioning the system prior to specification of sensors.

Standard Sensor Placement - for other placement options, please consult factory. For functionality and limitations, please see sensor details above.





*Lit section will be the fixture length minus 3" for sensor plate.

Notes: 1. For spacing between sensors, please consult the sensor manufacturer.
2. Exact sensor placement and coverage will be defined by approved factory drawing.
3. Sections controlled by sensors may not be symmetrical - consult factory for layout.

Standard Recessed (L60) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

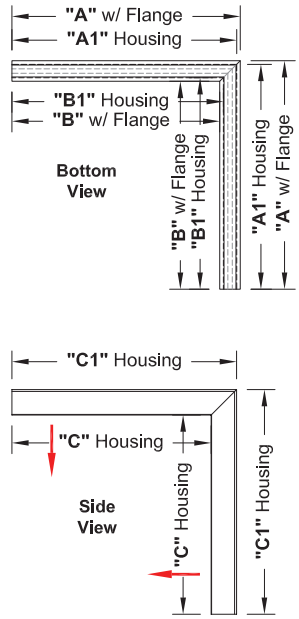
The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

*For sensors in configurations, please consult factory.

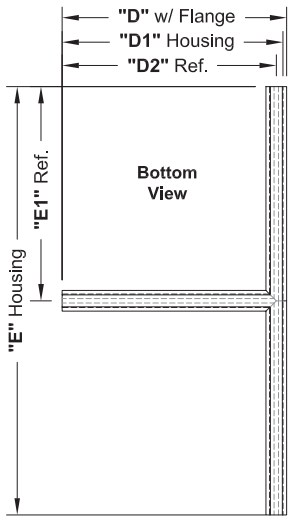
Project Specific Recessed (L60) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

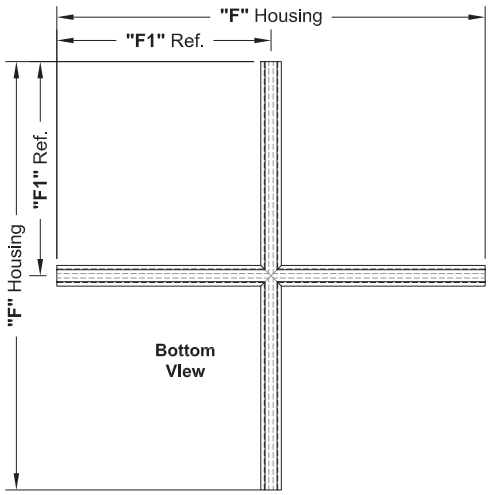
L9 - Lit Horizontal Corner



T9 - Lit "T" Section



X9 - Lit "X" Section



Recessed (L60) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
"A" Housing (Outside)	2' - 1 1/4"	642						
"A1" Housing (Inside)	1' - 10 15/16"	582						
"B" Housing (Outside)			1' - 11 1/2"	597				
"B1" Housing (Inside)			2' - 3 1/16"	688				
"C" Housing (Inside)					2' - 1 1/4"	642		
* "C1" Ref.					2' - 1/8"	612		
"D" Housing					4' - 3/16"	1224		
* "D1" Ref.					2' - 1/8"	612		
"E" Housing							4' - 3/16"	1224
* "E1" Ref.							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Standard Recessed (L6R1/2) shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example, leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example, 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

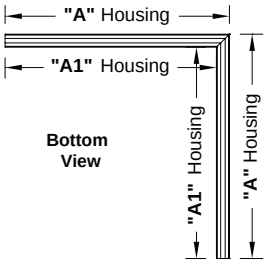
*For sensors in configurations, please consult factory.

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

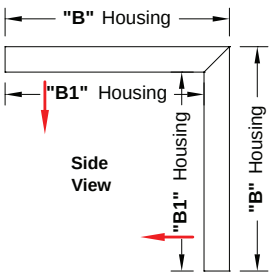
Project Specific Recessed (L6R1/2) shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

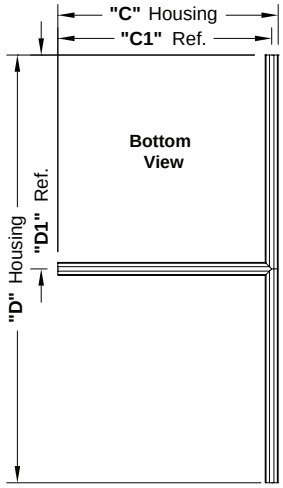
L9 - Lit Horizontal corner



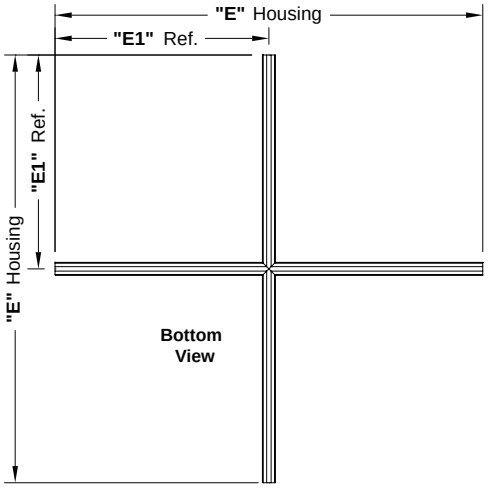
V9 - Lit Inside corner



T9 - Lit "T" section



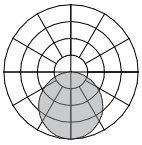
X9 - Lit "X" section



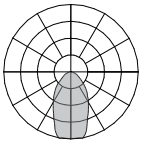
Recessed (L6R1/R2) Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
"A" w/Flange (Outside)	2' - 1 3/4"	654						
"A1" Housing (Outside)	2' - 1 1/4"	642						
"B" w/Flange (Inside)	1' - 10 7/16"	570						
"B1" Housing (Inside)	1' - 10 15/16"	582						
"C" Housing (Inside)			2' - 3 1/16"	688				
"C1" Housing (Outside)			1' - 11 1/2"	597				
"D" w/Flange					2' - 1 3/4"	654		
"D1" Housing					2' - 1 1/4"	642		
* "D2" Ref.					2' - 1/8"	612		
"E" Housing					4' - 3/16"	1224		
* "E1" Ref.					2' - 1/8"	612		
"F" Housing							4' - 3/16"	1224
* "F1" Ref.							2' - 1/8"	612

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

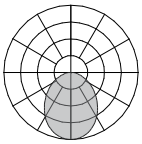
Photometry



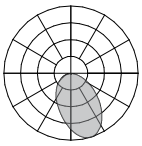
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2804	701	8.8	79



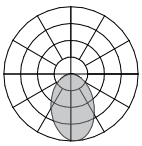
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3251	813	8.8	92



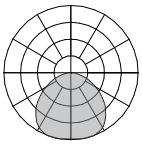
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3002	751	8.8	85



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3032	758	8.8	86



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2807	702	8.8	79



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3926	982	8.8	111

M60 Recessed	
CCT Multiplier	
4000K	1.05
3500K	1.00
3000K	0.96
2700K	0.92
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

Received
By PCM3 at 12:54 pm, April 27, 2023

prescolite

DATE: | LOCATION:

TYPE: LT-03 | PROJECT: Compton College -VAPA

CATALOG #:

LT- 03 / LT-03B / LT-3C

LITEISTRY

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

PHOTOMETRY
DIMENSIONAL DRAWINGS

FEATURES

- 4" architectural LED downlight delivering 600 – 4000 lm
- Five beam distributions from 0.3 to 1.2 Spacing Criteria
- Quiet reflector appearance with superior 50° optical cutoff
- 2700K – 5000K, 80+ and 90+ CRI options
- Available for New Construction (non-IC), IC and Chicago Plenum applications
- Variety of dimming protocol options including 0–10V, DALI, DMX, Lutron Forward Phase and EcoSystem
- NX Distributed Intelligence™ wired and wireless controls capability available

WET LOCATION | C SA US | ENERGY STAR | BUY AMERICAN SOLUTIONS — See Certification Specifications

RELATED PRODUCTS

- LTR-4RD-RFH Retrofit
- LTR-4RD SpectraSync
- LTR-4RDPH PowerHUBB
- 3" LITEISTRY Family
- 4" LITEISTRY Family
- 6" LITEISTRY Family

CONTROL TECHNOLOGY

NX DISTRIBUTED™ INTELLIGENCE

SPECIFICATIONS

CONSTRUCTION

- Standard Non-IC. Chicago Plenum and IC options
- Painted black durable steel platform with pre-installed bar hangers
- Pre-wired junction box with snap-on covers for easy access
- Snap-in connection from driver compartment allows easy installation
- Light Engine connections use plenum rated (CMP) cable

OPTICS

- Visually pleasing 50° cutoff to source and source image
- The light distribution is free of distracting bright spots or pixelation and the perimeter has a smooth transition
- Optical grade silicone lens integral to light engine
- High purity spun aluminum reflector, self-flanged
- Flush Mount flange option with mud-in ring available
- Large selection of anodized finishes and colors
- Painted cones and flange options available

ELECTRICAL

- Chip-on-board LED with 2 SDCM
- Multiple CCTs, 80+ or 90+ CRI
- Long LED life: L90 at >55,000 hours (TM-21)
- Universal voltage 120V–277V driver, 347V optional
- UL Class 2, inherent short circuit and overload protection, RoHS compliant
- Flicker free 0-10V dimming with 1% or <1% performance
- DALI, DMX, and Lutron Forward Phase and EcoSystem options
- Integral and remote emergency controller and battery pack options available
- NX or Lutron Vive control options available
- Refer to additional spec sheets for information on SpectraSync™ Tunable White or Dim-to-Warm or PowerHUBB™ PoE enabled solutions

INSTALLATION

- Accommodates ceiling thickness up to 2"
- Universal adjustable mounting brackets also accept 0.5" EMT conduit or 1.5" or 0.75" lathing channel (by others) or Prescolite accessory bar hangers (B24 or B6)
- Light Engine/Driver fully serviceable from above or below the ceiling

CERTIFICATIONS

- cCSAus certified to UL 1598
- Suitable for wet locations, covered ceiling. EM/ EMR: Suitable for damp locations.
- EM/EMR: Certified under UL 924 standard for emergency lighting and power equipment
- Approved for 8 (4 in/4 out) No. 12AWG conductors rated for 90°C through wiring
- ENERGY STAR® certified models available (See list and additional information on page 7)
- This product qualifies as a "designated country construction material" per FAR 52.225-11 Buy American-Construction. Materials under Trade Agreements effective 6/6/2020. See Buy American Solutions.

WARRANTY

- 5 year warranty
- See HLI Standard Warranty for additional information

KEY DATA	
Lumen Range	600-4000
Wattage Range	8-52
Efficacy Range (LPW)	90-99*
Reported Life (Hours)	L90 / >55,000
Input Current (mA)	65-433 (120V)

*Based on Specular, 35K, 80 CRI

HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

prescolite

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

ORDERING GUIDE

Example: LTR–4RD–H–SL10L–DM1–LTR–4RD–T–SL35K8MD–S

CATALOG #

HOUSING

LTR-4RD-H –

Aperture/Shape/Function		Lumen Package		Lumen Output	
LTR-4RD-H	4" Round Downlight New Construction Housing	**SL**	Standard Lumen	**06L**	600
				10L	1000
				15L	1500
		ML	Medium Lumen	**20L**	2000
				25L	2500
				30L	3000
		HL	High Lumen	**35L**	3500
				40L	4000

Driver Options		Control Options		Voltage		Housing Options	
DM1	0-10V Dimming to 1%	**NXE**	NX Enabled, Dual SmartPorts [3]	*Standard 120-277V*		**CP**	Chicago Plenum [7, 9]
DM01	0-10V Dimming to < 1%	**NXWE**	NX Wireless Enabled [3]	**34**	347V [6]	**IC**	IC rated [8, 9]
DMX	DMX with RDM dimming to < 0.1% [2]	**NXWD**	NX Wireless Enabled, Dual SmartPorts [3]			**EM**	Emergency Battery Pack with integral test switch and indicator light [9]
DALI	DALI Dimming to 1%	**LV**	Lutron Vive Enabled, 0-10V (requires 0-10V driver)			**EMR**	Emergency Battery Pack with remote test switch and indicator light [9]
2DM	Lutron Hi-Lume 2-wire Dimming to 1% (120V Forward Phase only) [2]	**LVE**	Lutron Vive Enabled, EcoSystem, (requires EDM)			**DTS**	Device Transfer Switch with Dimming Bypass [9, 11]
EDM	Lutron Hi-Lume EcoSystem Dimming to 1% [2]					**GTD**	Generator Transfer Device [9]
						F	Fuse

TRIM

LTR-4RD-T –

Aperture/Shape/Function		Lumen Package		CCT		CRI		Distribution	
LTR-4RD-T	4" Round Downlight Light Engine/Trim Assembly	**SL**	Standard Lumen	**27K**	2700K	**8**	80+CRI	**VNR**	Very Narrow (0.3 SC/20°) [13]
		ML	Medium Lumen	**30K**	3000K	**9**	90+CRI	**NR**	Narrow (0.4 SC/29°)
		HL	High Lumen	**35K**	3500K			**MD**	Medium (0.7 SC/44°)
				40K	4000K			**WD**	Wide (0.9 SC/61°)
				50K	5000K [1]			**XW**	Extra Wide (1.2 SC/78°)

TRIM CONTINUED

–

Reflector Finish		Reflector Color		Flange Color Options		Lower Trim Options		Reflector Options	
Finish not applicable with painted reflectors (WC or BC)		*Standard Clear*		*Standard matches reflector color*		**EM**	Pre-punched reflector for EM integral test switch and indicator	**AM**	Antimicrobial Coating [5]
S	Specular	**CG**	Champagne Gold	**WT**	White Flange [4]	**FM**	Flush Mount Mud-in Ring [10]		
SS	Semi-Specular	**BL**	Black	**BT**	Black Flange [4]	**WF**	Wide Flange		
MFC	American Matte™	**LW**	Light Wheat						
VS	Softglow®	**PW**	Pewter						
VSS	SoftSheen™	**WC**	Painted White Cone and Flange						
		BC	Painted Black Cone and Flange						

Accessories	
☐ **B24**	Set of two (2) 24" bar hangers for T-bar ceilings
☐ **B6**	Set of two bar hangers for ceiling joist up to 24" centers
☐ **FMR4-R**	Flush Mount Mud-In Ring Accessory, 4" Round
☐ **LiteGear**	LiteGear® Inverter, 125VA-250VA
☐ **LPS Series**	LightPower Micro-Inverter, 20VA-55VA
☐ **MOR4-R-WH**	Metal Oversized Ring, 4" Round, White (8.25" outside diameter)
☐ **MOR4-R-BL**	Metal Oversized Ring, 4" Round, Black (8.25" outside diameter)
☐ **LTR-SCA4-__**	Sloped Ceiling Adapter, 4", White [12]

Notes:

1 5000K available in 80+ CRI only.
2 2DM, EDM, DMX available in 10L-35L.
3 NX requires DM1 driver option.
4 WT not needed for WC, BT not needed for BC.
5 AM available with WC or Specular Clear (S or SWT). Consult factory for other colors.
6 347V requires DM1 driver option; not available in 06L or with Controls F, DTS, GTD, EM, EMR.
7 CP available up to 20L; not available with DMX, Controls, or EMR options.
8 IC available up to 20L; not available with Controls options.
9 Housing options (except Fuse) not available in combination.
10 Flush Mount Flange (FM) requires FMR accessory (sold separately).
11 DTS available with DM1, DM01, DALI, or EDM; not available with LVE.
12 Specify slope angle 5°-35° in 5° increments. Not available with EM, WF, or FM options.
13 VNR available up to 30L.

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

CONTROLS

NX Distributed Intelligence™ Lighting Controls:

Supports applications in a variety of deployment options- wired, wireless, hybrid. Integrates with and enables a wide array of luminaires including those with SpectraSync™ Color Tuning Technology.

NX DISTRIBUTED™ INTELLIGENCE

NX INTEGRATED CONTROLS REFERENCE								
NX Option	Sensor	Networkable	Scheduling	Occupancy	Daylight Harvesting	0–10V Dimming	On/off Control	Bluetooth® App Programming
NX Networked – Wired								
NXE	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R[1]
NX Networked – Wireless								
NXWE[2]	N/A	Yes	Yes	No	No	Yes	Yes	No[3]
NX Networked – Wired/Wireless								
NXWD	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R[1,3]

1 NXBTC/R needs to be plugged into an available NX SmartPort™ on the fixture network

2 Programming via App requires factory assistance

3 To program NXWE option, need to consult factory. If connected to an area controller, programming can be done from that

NX Design & Application Guide
NX Brochure

HUBBELL Lighting

prescolite

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

PERFORMANCE DATA TABLE

Performance data provided below is for 3500K, 80 CRI with Specular Clear reflector finish/color

Lumen Package	Nominal Lumens	Distribution	"Delivered Lumens"	Watts	LPW
06L	600	Very Narrow	691	7.6	91
		Narrow	785	7.8	101
		Medium	726	7.8	93
		Wide	664	7.8	85
		Extra Wide	644	7.8	83
10L	1000	Very Narrow	1132	11.8	96
		Narrow	1255	12.0	105
		Medium	1160	12.0	97
		Wide	1062	12.0	89
		Extra Wide	1030	12.0	86
15L	1500	Very Narrow	1623	17.2	94
		Narrow	1795	18.6	97
		Medium	1660	18.6	89
		Wide	1519	18.6	82
		Extra Wide	1474	18.6	79
20L	2000	Very Narrow	2032	22.4	91
		Narrow	2238	22.5	99
		Medium	2152	22.5	96
		Wide	2059	22.5	92
		Extra Wide	2028	22.5	90
25L	2500	Very Narrow	2447	28.6	86
		Narrow	2985	27.8	107
		Medium	2760	27.8	99
		Wide	2526	27.8	91
		Extra Wide	2451	27.8	88
30L	3000	Very Narrow	2855	35.9	80
		Narrow	3583	34.6	104
		Medium	3313	34.6	96
		Wide	3032	34.6	88
		Extra Wide	2941	34.6	85
35L	3500	Narrow	4280	42.9	100
		Medium	3957	42.9	92
		Wide	3622	42.9	84
		Extra Wide	3514	42.9	82
40L	4000	Narrow	4885	51.5	95
		Medium	4517	51.5	88
		Wide	4134	51.5	80
		Extra Wide	4011	51.5	78

HUBBELL Lighting

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DATE: LOCATION:

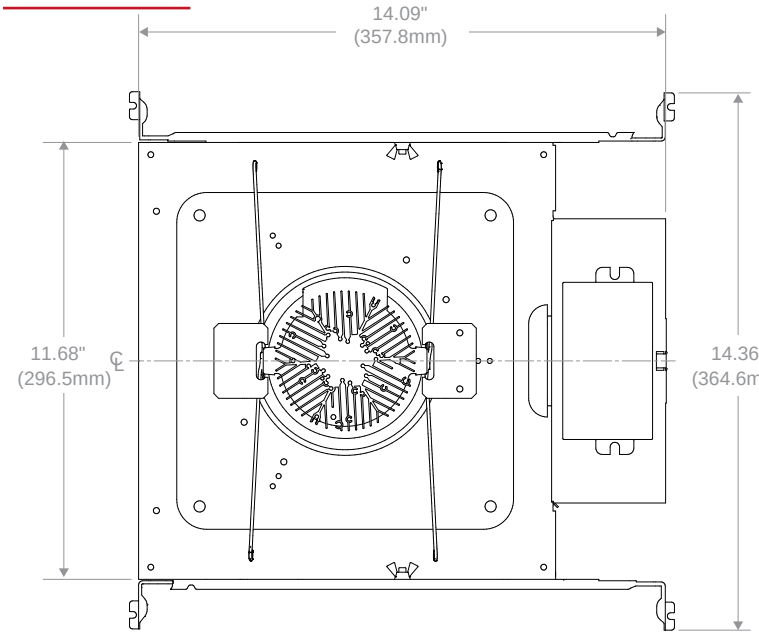
TYPE: PROJECT:

CATALOG #:

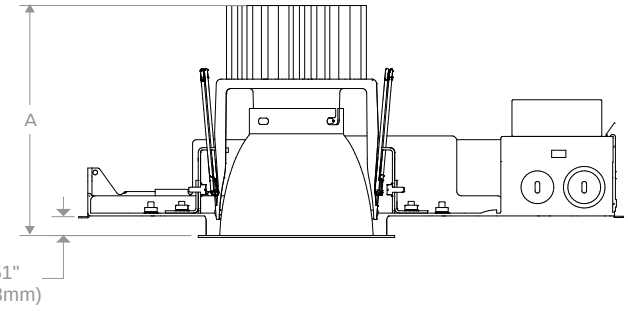
LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

DIMENSIONS



Top View

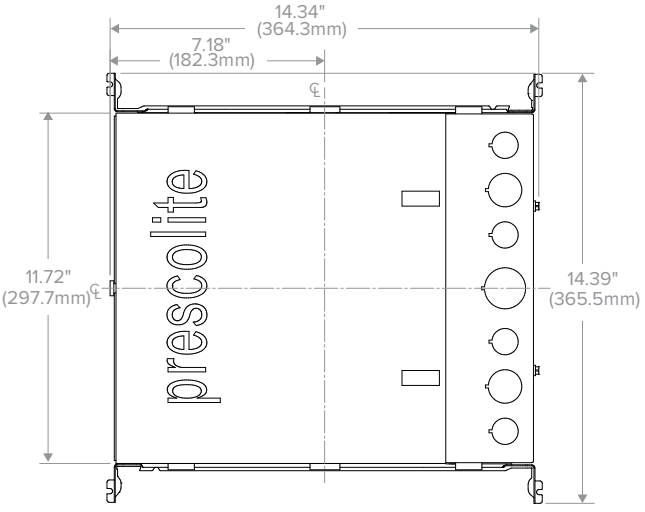


Dimensional Data		
Aperture		4.00" (101.6mm)
Flange:	Standard	5.25" (133.4mm)
	Flush Mount	4.50" (114.3mm)
Ceiling Cutout:	Standard	5.00" (127.0mm)
	Flush Mount	5.12" (130.0mm)
Ceiling Thickness:	Standard or w/ SCA 5-20° slope	0.50" to 2.00" (12.7mm to 50.8mm)
	With SCA 25-35° slope	0.50" to 1.75" (12.7mm to 44.6mm)

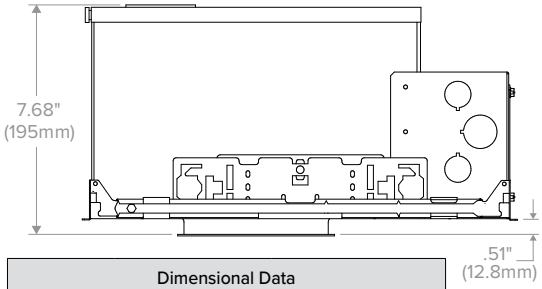
Lumen Package	"A"
06L-15L	4.97" (126.2mm)
20L-30L	6.15" (156.2mm)
35L-40L	7.33" (186.2mm)

SCA Sloped Ceiling Adapter accessory available, see LTR-SCA specification sheet and installation instructions for dimensional data and other details.

LTR-4RD-H New Construction



Top View



Dimensional Data		
Aperture		4.00" (101.6mm)
Flange:	Standard	5.25" (133.4mm)
	Flush Mount	4.50" (114.3mm)
Ceiling Cutout:	Standard	5.00" (127.0mm)
	Flush Mount	5.12" (130.0mm)
Ceiling Thickness:	Standard or w/ SCA 5-20° slope	0.50" to 2.00" (12.7mm to 50.8mm)
	With SCA 25-35° slope	0.50" to 1.75" (12.7mm to 44.6mm)

SCA Sloped Ceiling Adapter accessory available, see LTR-SCA specification sheet and installation instructions for dimensional data and other details.

LTR-4RD-H IC/CP

HUBBELL Lighting

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LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

PHOTOMETRY

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-ML35K8VNR-S

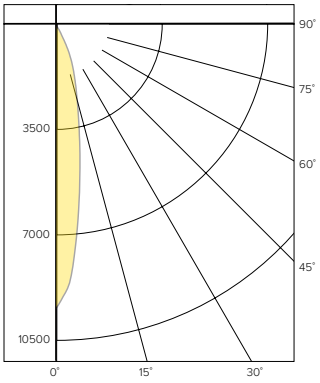
LUMINAIRE DATA

Test No.	**20.01331**
Description	**2000 lm, Very Narrow, 3500K, 80 CRI**
Delivered Lumens	**2032**
Watts	**22.4W**
Efficacy	**91**
Mounting	**Recessed**
Spacing Criterion	**0.3**
Beam Angle (FWHM)	**20**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	2011	99.0
0-60	2032	100.0
0-90	2032	100.0
0-180	2032	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	9388
5	7360
15	2780
25	1073
35	198
45	20
55	0
65	0
75	0
85	0
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	3489
55°	0
65°	0
75°	0
85°	0

*Candela/Square Meter

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-ML35K8NR-S

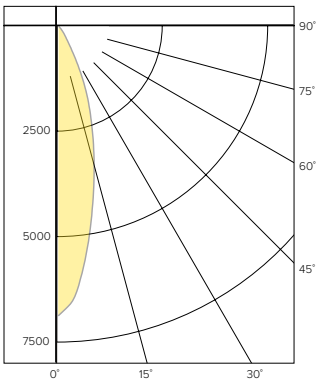
LUMINAIRE DATA

Test No.	**19.00532**
Description	**2000 lm, Narrow, 3500K, 80 CRI**
Delivered Lumens	**2238**
Watts	**22.5W**
Efficacy	**99.3**
Mounting	**Recessed**
Spacing Criterion	**0.4**
Beam Angle (FWHM)	**29**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	2208	98.6
0-60	2237	99.9
0-90	2238	100.0
0-180	2238	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	6877
5	6035
15	3284
25	1313
35	260
45	26
55	3
65	1
75	0
85	0
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	4535
55°	645
65°	292
75°	0
85°	0

*Candela/Square Meter

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-ML35K8MD-S

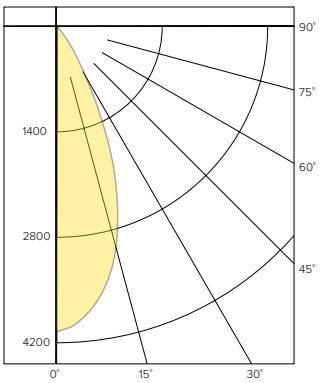
LUMINAIRE DATA

Test No.	**19.00533**
Description	**2000 lm, Medium, 3500K, 80 CRI**
Delivered Lumens	**2152**
Watts	**22.5W**
Efficacy	**95.6**
Mounting	**Recessed**
Spacing Criterion	**0.7**
Beam Angle (FWHM)	**44**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	2113	98.2
0-60	2151	99.9
0-90	2152	100.0
0-180	2152	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	4053
5	3893
15	3037
25	1493
35	366
45	34
55	3
65	1
75	0
85	0
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	5931
55°	645
65°	292
75°	0
85°	0

*Candela/Square Meter

IES FILE

IES FILE

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

PHOTOMETRY CONTINUED

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-ML35K8WD-S

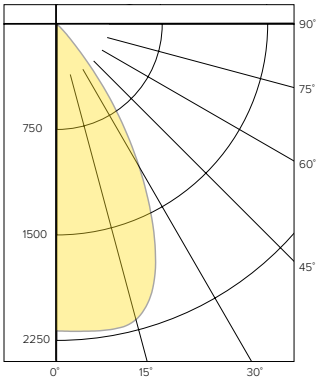
LUMINAIRE DATA

Test No.	**19.00534**
Description	**2000 lm, Wide, 3500K, 80 CRI**
Delivered Lumens	**2059**
Watts	**22.5W**
Efficacy	**91.6**
Mounting	**Recessed**
Spacing Criterion	**0.9**
Beam Angle (FWHM)	**61**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	1983	96.3
0-60	2056	99.8
0-90	2059	100.0
0-180	2059	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	2201
5	2210
15	2051
25	1504
35	692
45	169
55	10
65	3
75	1
85	0
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	11338
55°	1075
65°	584
75°	477
85°	0

*Candela/Square Meter

IES FILE

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-ML35K8XW-S

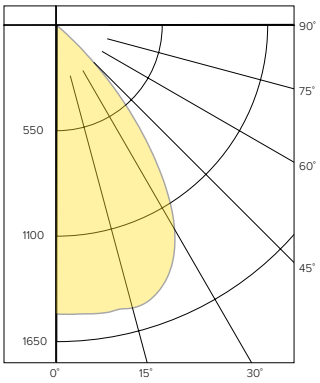
LUMINAIRE DATA

Test No.	**19.00535**
Description	**2000 lm, Extra Wide, 3500K, 80 CRI**
Delivered Lumens	**2028**
Watts	**22.5W**
Efficacy	**90.2**
Mounting	**Recessed**
Spacing Criterion	**1.2**
Beam Angle (FWHM)	**78**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	1794	88.5
0-60	2025	99.8
0-90	2028	100.0
0-180	2028	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	1235
5	1252
15	1392
25	1454
35	1010
45	256
55	6
65	2
75	1
85	0
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	44656
55°	1290
65°	584
75°	231
85°	477

*Candela/Square Meter

IES FILE

LUMEN MULTIPLIER

Option	27K8	30K8	35K8	40K8	50K8	27K9	30K9	35K9	40K9
Multiplier	0.94	0.98	1.00	1.01	1.02	0.81	0.84	0.85	0.85

Photometrics are published below at a nominal 3500 Kelvin, 80+ CRI. This table may be used to approximate the lumen values at different Kelvin temperatures. Power consumption would stay the same.

REFLECTOR FINISH MULTIPLIER (Based on Clear (Standard) Color)

Option	Specular (S)	Semi-Specular (SS)	American Matte (MFC)	Softglow (VS)	Softsheen (VSS)
Multiplier	1	1	0.984	0.888	0.938

REFLECTOR COLOR MULTIPLIER (Based on Semi-Specular (SS) Finish)

Option	Clear (Standard)	Champagne Gold (CG)	Black (BL)	Light Wheat (LW)	Pewter (PW)	White Cone (WC)	Black Cone (BC)
Multiplier	1	0.974	0.444	0.861	0.915	0.984	0.442

Multiply FINISH x COLOR to calculate other reflector finish and color combinations. Example: SoftGlow Pewter (VSPW) = 0.888 (VS) x 0.915 (PW) = 0.813

HUBBELL Lighting

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LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

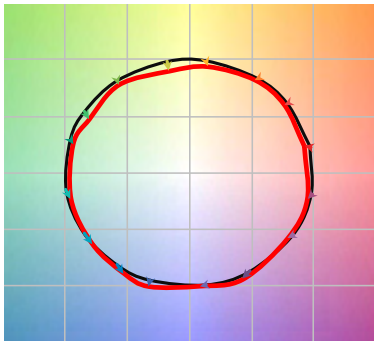
DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

TM-30 DATA

COLOR VECTOR GRAPHIC 3500K, 90 CRI

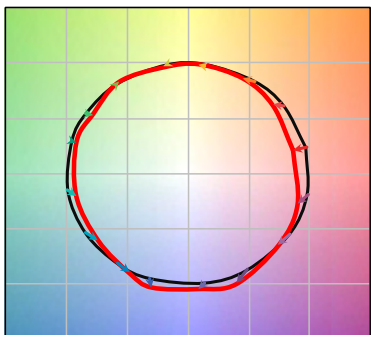


Reference Illuminant — Test Source

COLOR DISTORTION GRAPHIC 3500K, 90 CRI

TEST RESULTS - 3500K		
Value	80+ CRI	90+ CRI
R_f	84	88
R_g	95	95
CCT (K)	3411	3419
D_{UV}	0.0015	0.0042
x	0.4120	0.4147
y	0.3974	0.4052
CIE R_a	84	93
CIE R_9	11	62

COLOR VECTOR GRAPHIC 3500K, 80 CRI



Reference Illuminant — Test Source

COLOR DISTORTION GRAPHIC 3500K, 80 CRI

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD

LITEISTRY 4" ROUND DOWNLIGHT

ELECTRICAL DATA

DRIVER DATA		
Input Voltage	120-277 V	347 V
Input Frequency	50/60 Hz	50/60 Hz
Power Factor	≥0.90	≥0.90
THD	<20%	<20%
EMI Filtering (FCC 47 CFR Part 15)	Class A	Class A

* Values for DM1 option shown, values for other dimming options may vary.

WATTAGE DATA		
Lumen Output	Nominal Lumens	Wattage
06L	600	8
10L	1000	12
15L	1500	19
20L	2000	23
25L	2500	28
30L	3000	35
35L	3500	43
40L	4000	52

* Wattage may vary based on configuration and options selected

ADDITIONAL INFORMATION

DIMMING COMPATIBILITY CHART		
Dimming Driver	Manufacturer	Web Link
DM1 /DM01	Lutron DVTV	http://bit.ly/11jSvZg
DM1	Leviton AWRMG-7xx, AWSMG-7xx, AWSMT-7xx	http://bit.ly/1BJn2R9
EDM	Lutron	http://bit.ly/1vtjHAl
2DM	Lutron	http://bit.ly/1S4WjXK

DMX

See instruction sheet on www.prescolite.com for connection & installation information.

Central Inverters

For full fixture output in back-up mode, we recommend you visit www.dual-lite.com for your Central Lighting Inverter options. Please contact your local Hubbell representative for any assistance with proper sizing and loading of your inverter selection. Central lighting inverters must be ordered separately.
LiteGear: www.dual-lite.com/products/litegear_lg_series
LPS Series: www.dual-lite.com/products/lps

ENERGY STAR®

For a list of certified models, click on the ENERGY STAR® MODELS link or visit www.energystar.gov.

ENERGY STAR MODELS

HUBBELL Lighting

prescolite

DATE: | LOCATION:

TYPE: LT- 03A | PROJECT: Compton College - VAPA

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

LITEISTRY

FEATURES

- 4" architectural LED downlight delivering 600 – 2500 lm
- Non-conductive dead-front trim
- Available with four regressed lens options
- Suitable for wet locations, covered ceiling
- IP65 rated (room side)
- Anti-microbial finish, optional
- 2700K - 5000K, 80+ and 90+ CRI options
- Available for New Construction (non-IC), IC and Chicago Plenum applications
- Variety of dimming protocol options including 0-10V, DALI, DMX, Lutron Forward Phase and EcoSystem

WET LOCATION | C SA US | IP65

RELATED PRODUCTS

3" LITEISTRY Family | 4" LITEISTRY Family | 6" LITEISTRY Family

CONTROL TECHNOLOGY

NX DISTRIBUTED INTELLIGENCE

SPECIFICATIONS

CONSTRUCTION

- Standard Non-IC. Chicago Plenum and IC options
- Painted black durable steel platform with pre-installed bar hangers
- Pre-wired junction box with snap-on covers for easy access
- Snap-in connection from driver compartment allows easy installation
- Light Engine connections use plenum rated (CMP) cable

OPTICS

- Durable, non-conductive trim with 1/2" regressed lens
- Lens options include acrylic, polycarbonate, or tempered glass micro-prism, and clear acrylic
- Smooth room side lens surface for easy wipe down
- Available in white, black, or anti-microbial white trim color

ELECTRICAL

- Chip-on-board LED with 2 SDCM
- Multiple CCTs, 80+ or 90+ CRI
- Long LED life: L90 at >55,000 hours (TM-21)
- Universal voltage 120V–277V driver, 347V optional
- UL Class 2, inherent short circuit and overload protection, RoHS compliant
- Flicker free 0-10V dimming with 1% or <1% performance
- DALI, DMX, and Lutron Forward Phase and EcoSystem options
- Remote emergency controller and battery pack option available
- NX or Lutron Vive control options available

INSTALLATION

- Accommodates ceiling thickness up to 2"
- Universal adjustable mounting brackets also accept 0.5" EMT conduit or 1.5" or 0.75" lathing channel (by others) or Prescolite accessory bar hangers (B24 or B6)
- Light Engine/Driver fully serviceable from above or below the ceiling

CERTIFICATIONS

- cCSAus certified to UL 1598
- IP65 rated (room side) when properly installed per installation instructions
- Suitable for wet locations, covered ceiling. EMR: Suitable for damp locations.
- EMR: Certified under UL 924 standard for emergency lighting and power equipment
- Approved for 8 (4 in/4 out) No. 12AWG conductors rated for 90°C through wiring

WARRANTY

- 5 year warranty
- See HLI Standard Warranty for additional information

KEY DATA	
Lumen Range	600-2500
Wattage Range	8-28
Efficacy Range (LPW)	49-52*
Reported Life (Hours)	L90 / >55,000
Input Current (mA)	65-233 (120V)

*Based on 35K, 80 CRI

HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

prescolite

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

ORDERING GUIDE

Example: LTR–4RD–H–SL10L–DM1–LTR–4RD–-SHSL35K8-WTAML

CATALOG #

HOUSING

LTR-4RD-H –

Aperture/Shape/Function		Lumen Package		Lumen Output	
LTR-4RD-H	4" Round Downlight New Construction Housing	**SL**	Standard Lumen	**06L**	600
				10L	1000
				15L	1500
		ML	Medium Lumen	**20L**	2000
				25L	2500

–

Driver Options		Control Options		Voltage		Housing Options	
DM1	0-10V Dimming to 1%	**NXE**	NX Enabled, Dual SmartPorts [3]	*Standard 120-277V*		**CP**	Chicago Plenum [6, 8]
DM01	0-10V Dimming to < 1%	**NXWE**	NX Wireless Enabled [3]	**34**	347V [5]	**IC**	IC Rated [6, 9]
DMX	DMX with RDM dimming to < 0.1% [2]	**NXWD**	NX Wireless Enabled, Dual SmartPorts [3]			**EMR**	Emergency Battery Pack with remote test switch and indicator light [6]
DALI	DALI Dimming to 1%	**LV**	Lutron Vive Enabled, 0-10V (requires 0-10V driver)			**DTS**	Device Transfer Switch with Dimming Bypass [6, 7]
2DM	Lutron Hi-Lume 2-wire Dimming to 1% (120V Forward Phase only) [2]	**LVE**	Lutron Vive Enabled, EcoSystem, (requires EDM)			**GTD**	Generator Transfer Device [6]
EDM	Lutron Hi-Lume EcoSystem Dimming to 1% [2]					**F**	Fuse

TRIM

LTR-4RD-T –

Aperture/Shape/Function		Trim Style		Lumen Package		CCT		CRI	
LTR-4RD-T	4" Round Downlight Light Engine/Trim Assembly	**SH**	Non-Conductive Shower Trim	**SL**	Standard Lumen	**27K**	2700K	**8**	80+CRI
				ML	Medium Lumen	**30K**	3000K	**9**	90+CRI
						35K	3500K		
						40K	4000K		
						50K	5000K [1]		

TRIM CONTINUED

–

Trim Color		Lens Options		Options	
WT	White Trim and Flange	**AML**	Acrylic, Micro-prism	**AM**	Antimicrobial [4]
BT	Black Trim and Flange	**PML**	Polycarbonate, Micro-prism		
		GML	Tempered glass, Micro-prism		
		ACL	Acrylic, Clear		

Accessories	
☐ **B24**	Set of two (2) 24" bar hangers for T-bar ceilings
☐ **B6**	Set of two bar hangers for ceiling joist up to 24" centers
☐ **LiteGear**	LiteGear® Inverter, 125VA-250VA
☐ **LPS Series**	LightPower Micro-Inverter, 20VA-55VA

Notes:

1 5000K available in 80+ CRI only.
2 2DM, EDM, DMX available in 10L-25L.
3 NX requires DM1 driver option.
4 AM available with White (WT) only. Consult factory for other colors.
5 347V requires DM1 driver option; not available in 06L or with Controls F, DTS, GTD, EMR.
6 Housing options (except Fuse) not available in combination.
7 DTS available with DM1, DM01, DALI, or EDM; not available with LVE.
8 CP available up to 20L; not available with DMX, Controls, or EMR options.
9 IC available up to 20L; not available with Controls options.

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

CONTROLS

NX Distributed Intelligence™ Lighting Controls:
Supports applications in a variety of deployment options- wired, wireless, hybrid. Integrates with and enables a wide array of luminaires including those with SpectraSync™ Color Tuning Technology.

NX DISTRIBUTED™ INTELLIGENCE

NX INTEGRATED CONTROLS REFERENCE								
NX Option	Sensor	Networkable	Scheduling	Occupancy	Daylight Harvesting	0–10V Dimming	On/off Control	Bluetooth® App Programming
NX Networked – Wired								
NXE	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R[1]
NX Networked – Wireless								
NXWE[2]	N/A	Yes	Yes	No	No	Yes	Yes	No[3]
NX Networked – Wired/Wireless								
NXWD	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R[1,3]

1 NXBTC/R needs to be plugged into an available NX SmartPort™ on the fixture network
2 Programming via App requires factory assistance
3 To program NXWE option, need to consult factory. If connected to an area controller, programming can be done from that

PERFORMANCE DATA TABLE

Performance data provided below is for 3500K, 80 CRI.

Lumen Package	Nominal Lumens	Lens Description	Delivered Lumens	Watts	LPW
06L	600	Acrylic Micro-prism	358	7.8	46
		Polycarbonate Micro-prism	350	7.8	45
		Tempered Glass Micro-prism	366	7.8	47
		Acrylic Clear	366	7.8	47
10L	1000	Acrylic Micro-prism	572	12.0	48
		Polycarbonate Micro-prism	559	12.0	47
		Tempered Glass Micro-prism	586	12.0	49
		Acrylic Clear	586	12.0	49
15L	1500	Acrylic Micro-prism	818	18.6	44
		Polycarbonate Micro-prism	800	18.6	43
		Tempered Glass Micro-prism	838	18.6	45
		Acrylic Clear	838	18.6	45
20L	2000	Acrylic Micro-prism	1109	22.1	50
		Polycarbonate Micro-prism	1084	22.1	49
		Tempered Glass Micro-prism	1136	22.1	51
		Acrylic Clear	1136	22.1	51
25L	2500	Acrylic Micro-prism	1361	27.8	49
		Polycarbonate Micro-prism	1330	27.8	48
		Tempered Glass Micro-prism	1394	27.8	50
		Acrylic Clear	1394	27.8	50

NX Design & Application Guide
NX Brochure

prescolite

DATE: LOCATION:

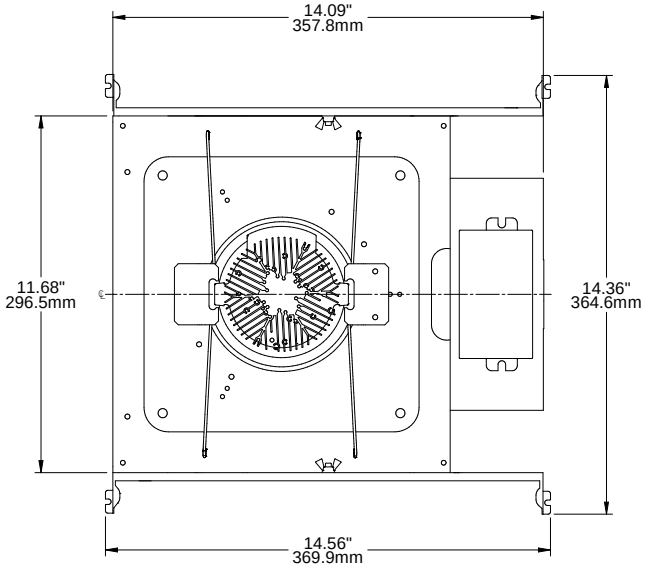
TYPE: PROJECT:

CATALOG #:

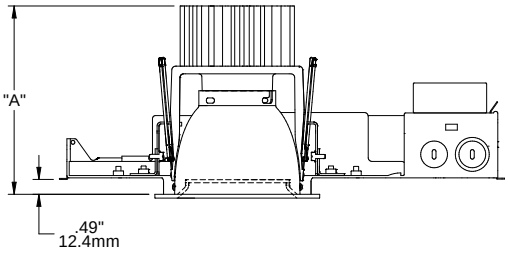
LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

DIMENSIONS



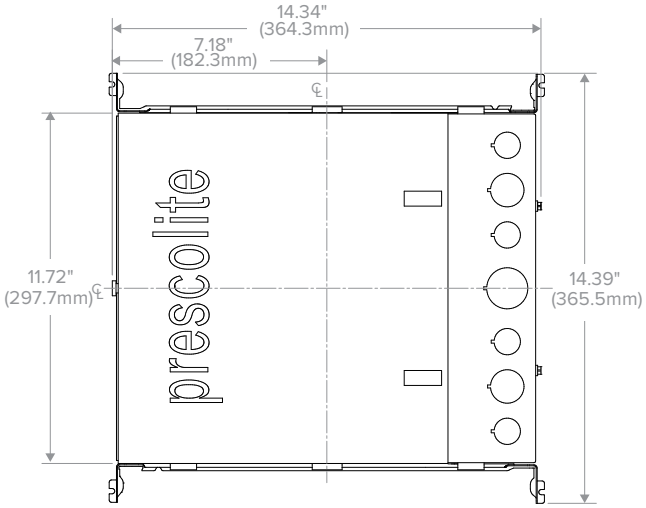
Top View



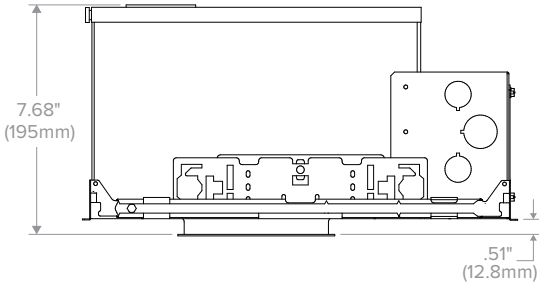
Dimensional Data		
Aperture		4.00" (101.6mm)
Flange	Standard	5.39" (136.9mm)
Ceiling Cutout	Standard	5.00" (127.0mm)
Ceiling Thickness		0.50" to 2.00" (12.7mm to 50.8mm)

Lumen Package	"A"
06L-15L	4.97" (126.2mm)
20L-25L	6.15" (156.2mm)

LTR-4RD-H-SH



Top View



Dimensional Data		
Aperture		4.00" (101.6mm)
Flange	Standard	5.39" (136.9mm)
Ceiling Cutout	Standard	5.00" (127.0mm)
Ceiling Thickness		0.50" to 2.00" (12.7mm to 50.8mm)

LTR-4RD-H-SH (IC/CP)

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

PHOTOMETRY

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-SHML35K8WTAML

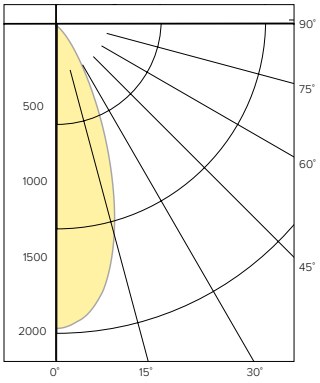
LUMINAIRE DATA

Test No.	**20.01609**
Description	**Acrylic Micro-prism lens, 3500K, 80 CRI**
Delivered Lumens	**1109**
Watts	**22.1W**
Efficacy	**50**
Mounting	**Recessed**
Spacing Criterion	**0.7**
Beam Angle (FWHM)	**41**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	1011	91.1
0-60	1093	98.5
0-90	1109	100.0
0-180	1109	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	1977
5	1920
15	1412
25	654
35	226
45	75
55	24
65	11
75	4
85	1
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	14790
55°	5892
65°	3600
75°	2428
85°	1045

*Candela/Square Meter

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-SHML35K8WTPML

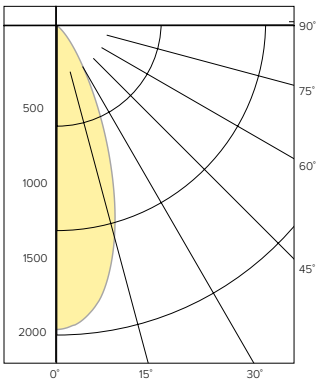
LUMINAIRE DATA

Test No.	**20.01611**
Description	**Polycarbonate Micro-prism lens, 3500K, 80 CRI**
Delivered Lumens	**1084**
Watts	**22.1W**
Efficacy	**49.1**
Mounting	**Recessed**
Spacing Criterion	**0.7**
Beam Angle (FWHM)	**41**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	989	91.3
0-60	1069	98.6
0-90	1084	100.0
0-180	1084	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	1938
5	1882
15	1381
25	641
35	222
45	73
55	23
65	10
75	4
85	2
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	14450
55°	5607
65°	3262
75°	2152
85°	978

*Candela/Square Meter

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-SHML35K8WTGML

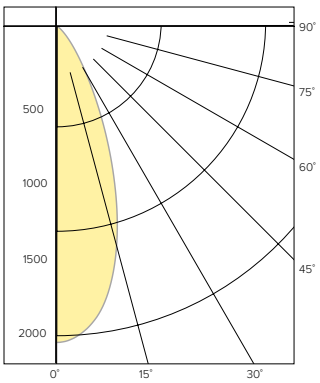
LUMINAIRE DATA

Test No.	**20.01612**
Description	**Tempered Glass Micro-prism lens, 3500K, 80 CRI**
Delivered Lumens	**1136**
Watts	**22.1W**
Efficacy	**51.5**
Mounting	**Recessed**
Spacing Criterion	**0.7**
Beam Angle (FWHM)	**41**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	1039	91.5
0-60	1119	98.5
0-90	1136	100.0
0-180	1136	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	2065
5	1997
15	1458
25	672
35	228
45	73
55	23
65	10
75	5
85	1
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	14460
55°	5608
65°	3480
75°	2454
85°	1445

*Candela/Square Meter

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

PHOTOMETRY CONTINUED

LTR-4RD-H-ML20L-DM1 / LTR-4RD-T-SHML35K8WTACL

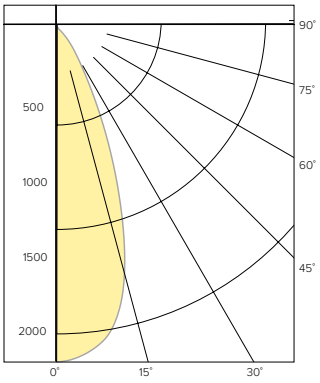
LUMINAIRE DATA

Test No.	**20.01613**
Description	**Acrylic Clear lens, 3500K, 80 CRI**
Delivered Lumens	**1136**
Watts	**22.1W**
Efficacy	**51.5**
Mounting	**Recessed**
Spacing Criterion	**0.7**
Beam Angle (FWHM)	**41**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-40	1078	94.9
0-60	1127	99.2
0-90	1136	100.0
0-180	1136	100.0

POLAR GRAPH



CANDELA DISTRIBUTION

Degree	Candela
0	2184
5	2136
15	1638
25	658
35	202
45	47
55	10
65	5
75	3
85	1
90	0

LUMINANCE DATA*

Vertical Angle	Average
45°	9400
55°	2390
65°	1794
75°	1420
85°	1191

*Candela/Square Meter

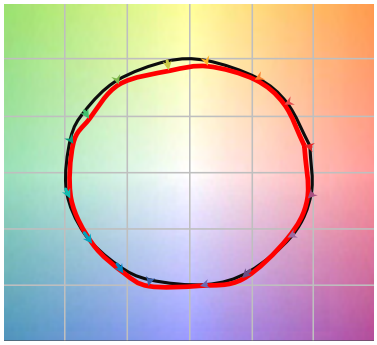
LUMEN MULTIPLIER

Option	27K8	30K8	35K8	40K8	50K8	27K9	30K9	35K9	40K9
Multiplier	0.94	0.98	1.00	1.01	1.02	0.81	0.84	0.85	0.85

Photometrics are published below at a nominal 3500 Kelvin, 80+ CRI. This table may be used to approximate the lumen values at different Kelvin temperatures. Power consumption would stay the same.

TM-30 DATA

COLOR VECTOR GRAPHIC 3500K, 90 CRI

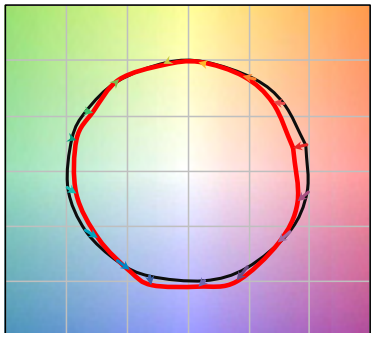


Reference Illuminant — Test Source

COLOR DISTORTION GRAPHIC 3500K, 90 CRI

TEST RESULTS - 3500K		
Value	80+ CRI	90+ CRI
R_f	84	88
R_g	95	95
CCT (K)	3411	3419
D_{UV}	0.0015	0.0042
x	0.4120	0.4147
y	0.3974	0.4052
CIE R_a	84	93
CIE R_9	11	62

COLOR VECTOR GRAPHIC 3500K, 80 CRI



Reference Illuminant — Test Source

COLOR DISTORTION GRAPHIC 3500K, 80 CRI

HUBBELL Lighting

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DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LTR-4RD (SH)

LITEISTRY 4" ROUND NON-CONDUCTIVE SHOWER DOWNLIGHT

ELECTRICAL DATA

DRIVER DATA		
Input Voltage	120-277 V	347 V
Input Frequency	50/60 Hz	50/60 Hz
Power Factor	≥0.90	≥0.90
THD	<20%	<20%
EMI Filtering (FCC 47 CFR Part 15)	Class A	Class A

* Values for DM1 option shown, values for other dimming options may vary.

WATTAGE DATA		
Lumen Output	Nominal Lumens	Wattage
06L	600	8
10L	1000	12
15L	1500	19
20L	2000	23
25L	2500	28

* Wattage may vary based on configuration and options selected

ADDITIONAL INFORMATION

DIMMING COMPATIBILITY CHART		
Dimming Driver	Manufacturer	Web Link
DM1 /DM01	Lutron DVTV	http://bit.ly/11jSvZg
DM1	Leviton AWRMG-7xx, AWSMG-7xx, AWSMT-7xx	http://bit.ly/1BJn2R9
EDM	Lutron	http://bit.ly/1vtjHAl
2DM	Lutron	http://bit.ly/1S4WjXK

DMX

See instruction sheet on www.prescolite.com for connection & installation information.

Central Inverters

For full fixture output in back-up mode, we recommend you visit www.dual-lite.com for your Central Lighting Inverter options. Please contact your local Hubbell representative for any assistance with proper sizing and loading of your inverter selection. Central lighting inverters must be ordered separately.
LiteGear: www.dual-lite.com/products/litegear_lg_series
LPS Series: www.dual-lite.com/products/lps

HUBBELL Lighting

ADVANCED HIGH CEILING

Signum 8 - Standard

METEOR

8-inch aperture high lumen with lumen output 3230 – 4220lm.

Quantity		Type	LT- 04
Project	Compton College - VAPA	Note	

Electrical System

- 4220lm (45W)
- Power Input: Universal (120-277V)
- Operating Temperature: -13°F~112°F
- Surge Protection: 2.5KV
- Power Factor Greater than 0.9
- Remote Emergency Pack: Bodine BSL20B2UEK55C1I1

LED Technology

- 2700K, 3000K, 3500K, 4000K, 5000K
- 85 CRI
- Beam Angle: 25°, 40°, 60°, 100°
- Rated Life > 60,000 Hours (L70)

Advanced Dimming

(Proprietary VX Driver is incorporated to all dimming options for video flicker-free lighting)

- Standard 0-10V dims to 10%
- Superior 0-10V: dims to 1%
- DMX: high resolution dims to 0.1% (Supports ANSI E1.20 RDM protocol)
- TRC: Line-voltage phase control, dims to 1% (120V only)
- LDE1: Hi-Lume 1% EcoSystem LED Driver with Soft-on, Fade-to-Black (UNV only)

Housing

- Diameter: 8.26″ (210mm)
- Height: 9.25″ (235mm)
- Material: Steel, Aluminum
- Weight: 11.02 lbs

Mounting

- Surface Mount
- Stem 2ft, 4ft; 37° Swivel Canopy Included
- Adjustable Aircraft Cable 10ft
- Wall Mount
- Yoke Mount

Warranty

- 5-year limited warranty

Listing

- ETL Dry Location Listed
- CE

ADVANCED HIGH CEILING

Signum 8 - Standard

How to Specify:

Ordering Example: SS8-45-358-UNV-SPV-40-BLK-AD10

4-5 weeks lead time on over 75% of specifications.

Model	Wattage	CCT / CRI	Voltage	Dimming
SS8			UNV	
SS8 Signum 8	45 45W	278 2700K / CRI85 308 3000K / CRI85 358 3500K / CRI85 408 4000K / CRI85 508 5000K / CRI85	UNV 120-277V	STV STV Standard 0-10V dims to 10% SPV Superior 0-10V dims to 1% DMX DMX dims to 0.1% (XLR Sockets) DMX(RJ45) DMX dims to 0.1% (RJ45 Sockets) TRC[1] Line-voltage phase control, dims to 1% (120V only) LDE1 Hi-Lume 1% EcoSystem LED Driver with Soft-on, Fade-to-Black (UNV only) [1]Option is not compatible with 45W

Beam Angle	Finish	Mounting	Accessories
25 25º 40 40º 60 60º WD 100º	BLK Black WHT White	SUM Surface Mount ST2 Stem 2ft ST4 Stem 4ft AD10 Adjustable Aircraft Cable 10ft WLM Wall Mount YKM Yoke Mount	SPD[1] Surge Protector EMP Remote Emergency Pack [1] Surge protector for up to 10KV. Applicable for unstable mains or facilities using high power machineries

ADVANCED HIGH CEILING

Signum 8 - Standard

Delivered Lumens*

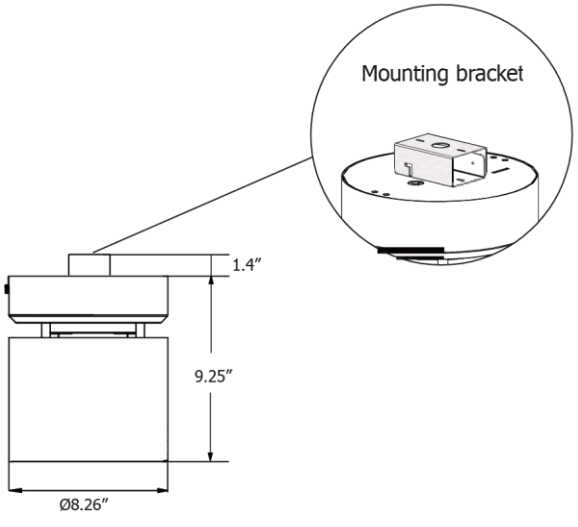
Wattage / CCT	SS8-45
	Beam Angle: 25°
5000K	4220 lm
4000K	3770 lm
3500K	3490 lm
3000K	3350 lm
2700K	3230 lm

*Tolerance± 8%

Current Consumption

Volt / Wattage	120V	277V
45W	0.47A	0.20A

Dimensions

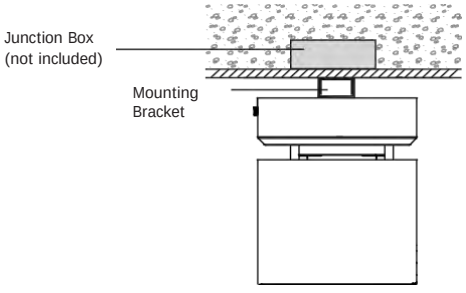


8-inch 45W

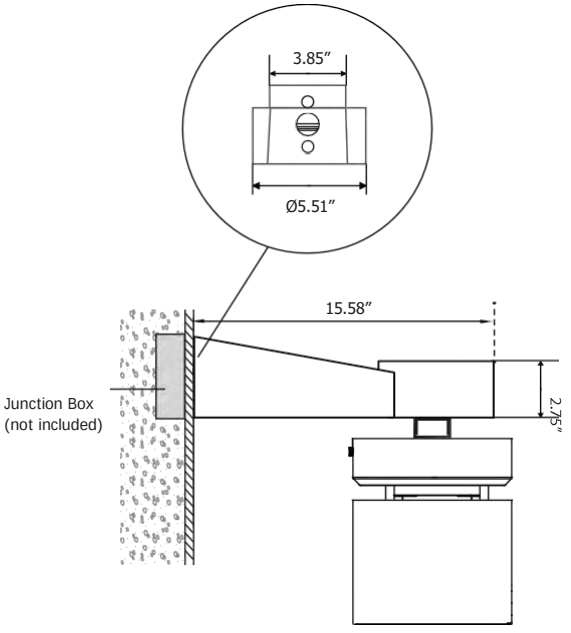
ADVANCED HIGH CEILING

Signum 8 - Standard

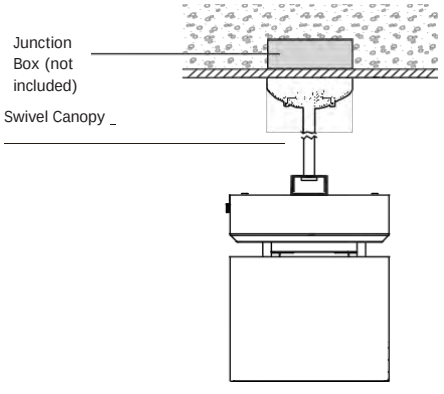
Mounting Options



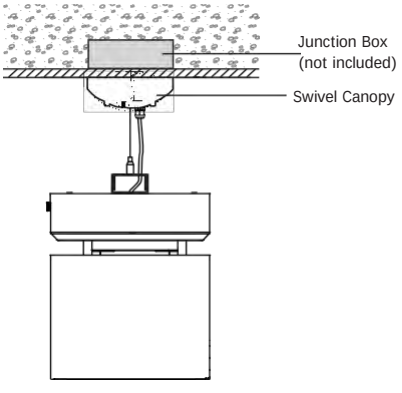
Surface Mount



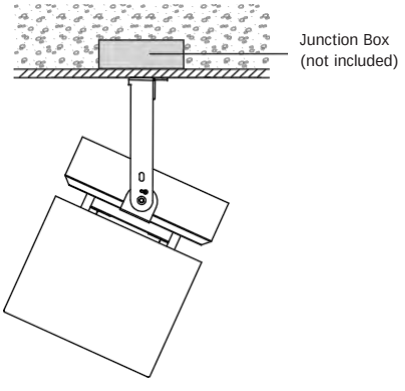
Wall Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

ADVANCED HIGH CEILING

Signum 8 - Standard

DMX Requirements*

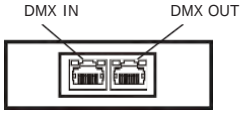
The Signum 8 LED fixture with DMX is a ONE CHANNEL DMX unit.

When placing order, please indicate DMX address. (The DMX address will be listed on the back of the fixture.)

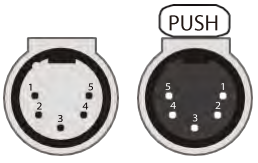
The LED fixture provide RJ45 Socket or XLR socket to connect. (DMX cable NOT included.)

The final fixture should be terminated by the use of DMX Terminator (by others).

RJ45 Sockets



XLR Sockets

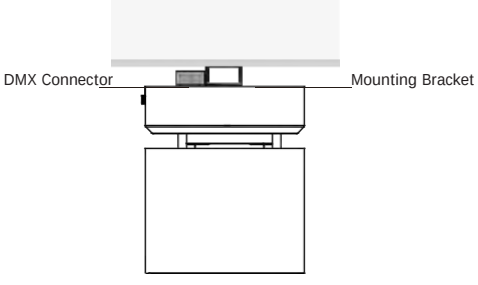


CONNECTION	RJ45 (CAT5e)	5-PIN XLR
Common	WHITE/BROWN(PIN7) & BROWN (PIN 8)	PIN 1
Signal -	ORANGE (PIN 2)	PIN 2
Signal +	WHITE/ORANGE (PIN 1)	PIN 3
Spare	-	PIN 4
Spare	-	PIN 5

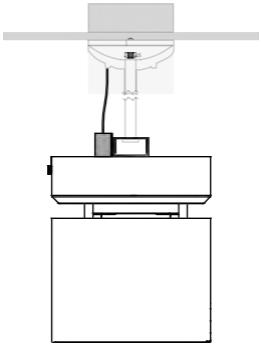
Compatible DMX Cabling List

DMX uses a cable consisting of two twisted pairs plus a shield to carry data. The cable must be specifically impedance matched for the digital DMX signal, meaning that microphone cable or other non-rated cable must not be used to carry DMX. Network cable (Cat5, 5e or 6 cable) may be used to carry DMX in an installation; however special consideration must be given to shielding and termination. Under no circumstances should solid core cable like Cat5 be terminated into a screw down connector.

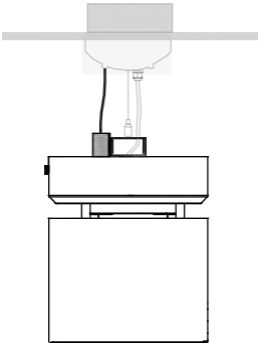
Meteor recommends the use of Belden 9729 for DMX installation. Belden 9729 is a two pair cable, which allows for a spare pair for 'out and back' type terminations if needed. Below is a list of other compatible Belden cables.



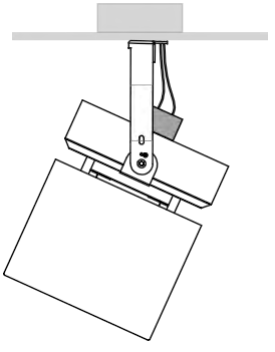
Surface Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

Compatible LTE Dimmer List

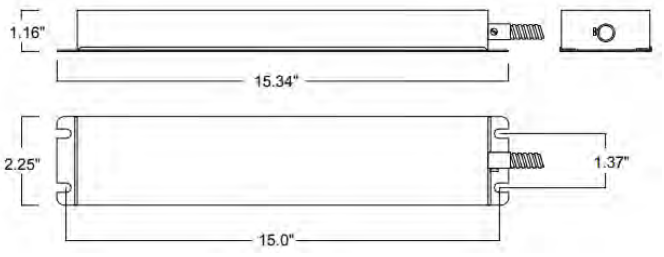
LUTRON PART NO.

RRD-6NA-	RRT-G5NEW-	RRT-GH	HQRD-10ND-	HQRT-GH	HQRD-HN	PD-10NXD-
RRD-6ND	RRT-G25LW-	HQRD-6NA-	MRF2-6ND-120-	HQRT-G25LW-	GT-250M-	PD-5NE-
RRD-10ND-	RRD-HN	HQRD-6ND-	MRF2S-6ND-120-	HQRT-G5NEW-	GTJ-250M-	

ADVANCED HIGH CEILING

Signum 8 - Standard

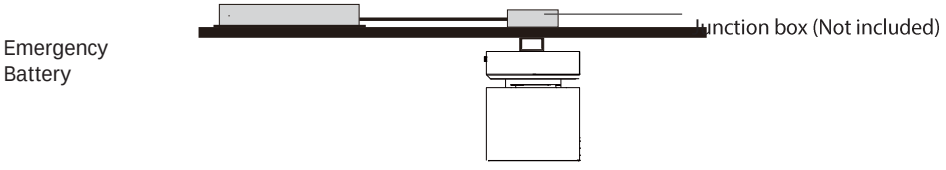
Remote Emergency Pack



Emergency Pack Lumen Output Table

CCT	2700K	3000K	4000K	5000K
Lumen	1640 lm	1760 lm	1890 lm	1950 lm

Mounting with standard celling recessed Junction BOX



DUAL LITE®

DATE: LOCATION:

TYPE: LT- 05 INV PROJECT: Compton College - VAPA

CATALOG #:

LG Series

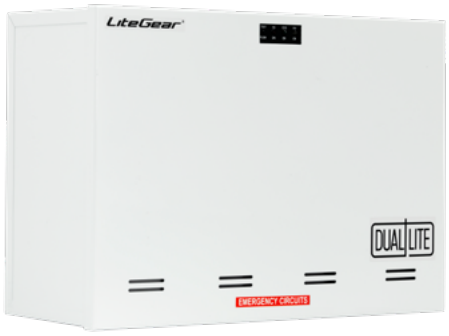
SINGLE-PHASE CENTRAL LIGHTING INVERTER

LiteGear®

BROCHURE

FEATURES

- AC output provides full lumen output for emergency lighting loads
- Compatible with LED, fluorescent and incandescent lamps
- Pure sine wave output mitigates LED inrush current
- For normally-on, normally-off and switched loads
- 90-minute emergency operation
- Input/Output VAC : 120/120 or 277/277
- 125 – 250VA maximum capacity
- UL 924 Listed
- UL Plenum rating on recessed T-Grid ceiling model
- Self-testing/diagnostics and Adjustable Output available



LG250S 250VA Surface Mount Model

LG125S 125VA
Surface Mount Model

LG125T
125VA Recessed
Ceiling T-Grid Mount Model

LG125R 125VA Recessed
Wall Mount Model

UL® LISTED 56B5 EMERGENCY LIGHTING EQUIPMENT

BC

SPECIFICATIONS

APPLICATION

- Designed for indoor installation in commercial or industrial applications.
- Emergency AC power is supplied to lighting fixtures equipped with incandescent, linear fluorescent, compact fluorescent or LED lamps
- The lighting load can be installed at a distance of up to 1,000 feet from the LiteGear® central lighting inverter
- Observe all required AC conductor sizing requirements
- When using LED lamps, consider LED in-rush current in load calculations
- Ceiling T-Grid mount model approved for use in City of Chicago

OPERATION

- When normal utility supplied power is interrupted, the LiteGear® Series unit will automatically transfer to emergency mode in less than 2-seconds and begin supplying inverted, battery-derived pure sine wave output power to the load for 90 minutes
- The unit is capable of operating normally on, normally off or switched loads
- A low voltage battery disconnect circuit will prevent “deep discharge” damage to the battery
- The charging circuit will bring the batteries to full recharge within UL time standards
- A “brownout” circuit will automatically transfer the unit to emergency power if the utility voltage falls to a pre-determined “low line” limit

CONSTRUCTION

- The LiteGear® enclosure and cover are constructed of heavy-duty, steel with a white powder-coat paint finish.

COMPLIANCES

- UL 924 (Emergency Lighting)
- UL 2043 (Plenum Air Handling Spaces) and City of Chicago (CCEA) for LG125T
- Life Safety Code (NFPA 101)
- National Electrical Code (NFPA 70)
- State and Local Code compliant
- CEC Title 20 Compliant

WARRANTY

- Unit and Electronics: 3 years full*
- Self-Test Model Unit and Electronics: 5 years full*
- SLA Lead Calcium Battery: 3 years full, 7 years pro-rata

* excludes fuses

KEY DATA	
Input/Output (VAC)	120/120 or 277/277
Wattage Range	110/220W
Input Current Range (Amps)	0.5 - 2.4

HUBBELL Lighting

DUAL LITE®

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

LG Series

SINGLE-PHASE CENTRAL LIGHTING INVERTER

ORDERING GUIDE

Example: LG125R-AO

CATALOG #

LG							
Model		**Capacity**		**Mounting**		**Self-Diagnostics**		**Dimming Control**	
LG	Litegear® Central Ligthing Inverter	**125**	125VA/110W	**S**	Surface Wall	**Blank**	None	**Blank**	None
		250	250VA/220W[3]	**R**	Recessed Wall[1]	**I**	Self Testing/Diagnostics[2,4]	**AO**	Adjustable Output (4 - levels)
				T	Recessed Ceiling T-Grid[1]				

Accessories (Order Separately)

RTSLP Remote Test Switch

Notes:

1. Only available on 125VA/110W version
2. Only available on 250VA/220W version
3. Housing (93098085) and batteries (93068259) ship in separate cartons
4. Housing (93098087) and batteries (93068259) ship in separate cartons

SPECIFICATIONS

ELECTRONICS

Input/Output: 120/120VAC or 277/277VAC, 60 Hz

Input/Output Connections: Terminal block

Operating Temperature Range: 20°C to 30°C (68°F to 86°F)

AC Lockout: Prevents battery discharge following installation when branch circuit AC power is not present.

Low Voltage Battery Disconnect: Protects the battery from damaging "deep discharge" conditions during prolonged power failures.

Brownout Protection: Automatically transfers to emergency power when utility voltage drops to a point that would cause fluorescent lamps to extinguish.

Overload and Short Circuit Protection: AC and DC protection provided by fuses and automatic shut down.

Test Means: Manual "TEST" button.

LED Indicators: LG125/LG250: "AC-ON" (red), "Charging-ON" (green), "Inverter On" (amber) LG250SI: "Normal Mode" (green steady), "Test Mode" (green blink), "High Charge" (red/green blink), "Inverter ON" (amber).

BATTERY

Maintenance-free, SLA lead calcium with 10 year rated life.

OPTIONAL SELF-TEST/SELF DIAGNOSTICS

Provides visual indication for battery, charger and load faults. Conducts automatic 30-second battery discharge test every 30 days, a 30-minute test every 6 months, and a 90-minute test once a year. Test switch allows for manual initiation of a 30-second, a 30-minute or a 90-minute system test

OPTIONAL ADJUSTABLE OUTPUT

Allows dimmable LED fixtures with 0-10V drivers to be connected to and powered by the LiteGear inverter during power outages. In emergency mode, two independent output circuits disconnect the load side of the local dimmer control, and connect the selected loads to the LiteGear output(s). Both emergency circuits are user-programmable to operate the connected fixtures at approximately 25%, 50%, 75% or 100% of nominal output during power outages.

	LG125S	LG125R	LG125T	LG250S	LG250SI
Power Rating (VA - W)	125/110			250/220	
Power Factor Range	0.88 lead to 0.88 lag				
Form and Fit	Wall Mount Surface	Wall Mount Recessed	Ceiling Mount Recessed T-grid	Wall Mount Surface	
Weight (lb) with batteries	42	42	43	60	
Maximum Input Current (A)	120 VAC: 1.2 A 277 VAC: 0.52 A	120 VAC: 1.2 A 277 VAC: 0.52 A	120 VAC: 1.2 A 277 VAC: 0.52 A	120 VAC: 2.4 A 277 VAC: 1.1 A	
System DC Voltage	24			48	
Recharge Time (Hr)	96			96	

OUTPUT LOADING

	Maximum Load (Watts)							
Dimming Circuits' Output (V)	2.5		5.0		7.5		10.0	
Model	Norm Mode	Emerg Mode	Norm Mode	Emerg Mode	Norm Mode	Emerg Mode	Norm Mode	Emerg Mode
LG125S-AO	400	110	200	110	133	110	110	110
LG125R-AO	400	110	200	110	133	110	110	110
LG125T-AO	400	110	200	110	133	110	110	110
LG250S-AO	800	220	400	220	267	220	220	220
LG250SI-AO	800	220	400	220	267	220	220	220

HUBBELL® HUBBELL Lighting

DUAL LITE®

DATE: LOCATION:

TYPE: PROJECT:

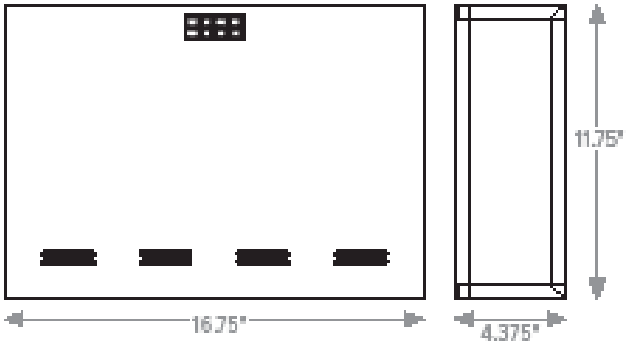
CATALOG #:

LG Series

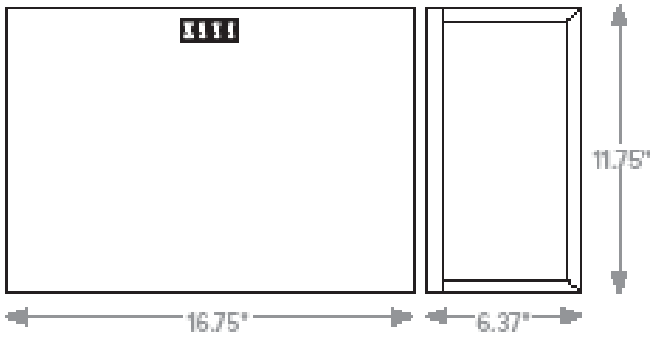
SINGLE-PHASE CENTRAL LIGHTING INVERTER

DIMENSIONS

LG125S Wall Mount Surface Model

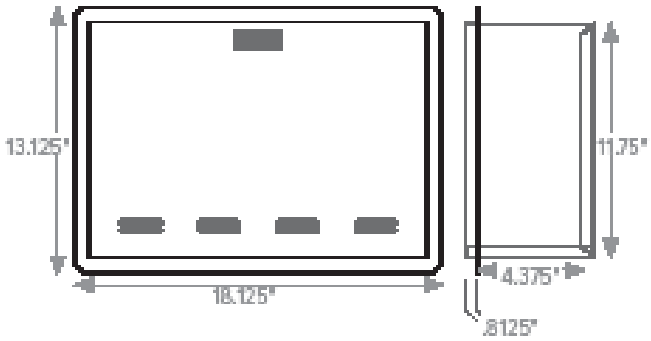


LG250S and LG250SI Wall Mount Surface Models



LG125T Recessed Ceiling T-Grid Mount Model

LG125R Recessed Wall Mount Model



HUBBELL Lighting

OCL ARCHITECTURAL LIGHTING

PROJECT NAME: Compton College - VAPA TYPE: LT- 05

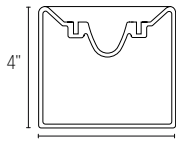
QTY: _____

Glowring™

PENDANT

FEATURES

- AVAILABLE IN 80+ CRI AND 90+ CRI
- SEAMLESS ONE-PIECE MOLDED DIFFUSER
- FULLY ENCLOSED TOP SURFACE TO MINIMIZE ACCUMULATION OF DUST AND DEBRIS
- AVAILABLE WITH METAL TRIM ON INNER DIAMETER OR OUTER DIAMETER
- FIELD REPLACEABLE LEDS AND DRIVERS
- 3 STEP LED BINNING



PROFILE VIEW

MADE IN USA

CATALOG CODES

A	-	B	-	C	-	MW	-	E	-	F	-	UNV	-	H	-	I	-	J
SERIES		HANGING SYSTEM		SIZE		DIFFUSER		FINISH		LIGHT SOURCE		VOLTAGE		OAH		CONTROL		OPTIONS

SPECIFY CATALOG CODE

A — SERIES

GL1 GLOWRING

GL2 GLOWRING OUTER TRIM

GL3 GLOWRING INNER TRIM

B — HANGING SYSTEM

P1EM	PENDANT WITH VERTICAL AIRCRAFT CABLES TO SEPARATE MOUNTING POINTS AND POWER CORD TO CANOPY (REMOTE DRIVER)
P1DA	PENDANT WITH VERTICAL AIRCRAFT CABLES TO SEPARATE MOUNTING POINTS AND POWER CORD TO CANOPY WITH INTEGRAL DRIVER
P1EC	PENDANT WITH ANGLED AIRCRAFT CABLES AND POWER CORD TO CANOPY (REMOTE DRIVER)
P1DB	PENDANT WITH ANGLED AIRCRAFT CABLES AND POWER CORD TO CANOPY WITH INTEGRAL DRIVER

C — SIZE

24 **36** **48** **60** **72**

D — DIFFUSER

MW MATTE WHITE

E — FINISH

POWDER COAT FINISHES

BKP	BLACK	**MWP**	MATTE WHITE
BMP	BRASS METALLIC	**SGP**	STEEL GRAY
BNP	BRONZE	**SMP**	SILVER METALLIC
BTP	BLACK TEXTURED	**SWP**	SKY WHITE
GRP	GRAPHITE	**WTP**	WHITE TEXTURED
GLP	GOLDTASTIC		

PREMIUM METAL FINISHES

BAL BRUSHED ALUMINUM

NFA NO FINISH AVAILABLE (**GL1** WITH **P1EM** ONLY)

F — LIGHT SOURCE

LED OUTPUT	COLOR TEMP (80+ CRI)	COLOR TEMP (90+ CRI)
LED1		
LED2	**27K**	**927K**
	30K	**930K**
	35K	**935K**
	40K	**940K**

G — VOLTAGE

UNV 120-277

H — OAH*

48 **100** **144**

I — CONTROL

DM1 0-10V DIMMING 1%

DM3 LUTRON HI-LUME ECOSYSTEM 1% (LDE1)

J — OPTIONS

ULD DAMP LABEL

BIOS BIOS SKYBLUE™ OR BIOS SKLYBLUE™ DYNAMIC LIGHT ENGINE**

MOD MODIFIED LUMINAIRE (CONTACT LOCAL REP)

SAMPLE CODE: GL1-P1EM-36-MW-NFA-LED1/35K-UNV-48-DM1

*For Minimum OAH, see hanging systems details. Fixture will ship with one of three standard OAH's (48", 100" or 144") field adjustable to the desired height.

Contact factory for **BIOS SkyBlue® or **BIOS SkyBlue® Dynamic** light engine and control options.

Fixtures with P1EM hanging system, canopy will be MWP unless specified.

Fixtures with P1DA, P1EC and P1DB hanging system, canopy will match finish choice.

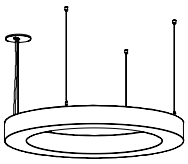
Power cord white unless specified.

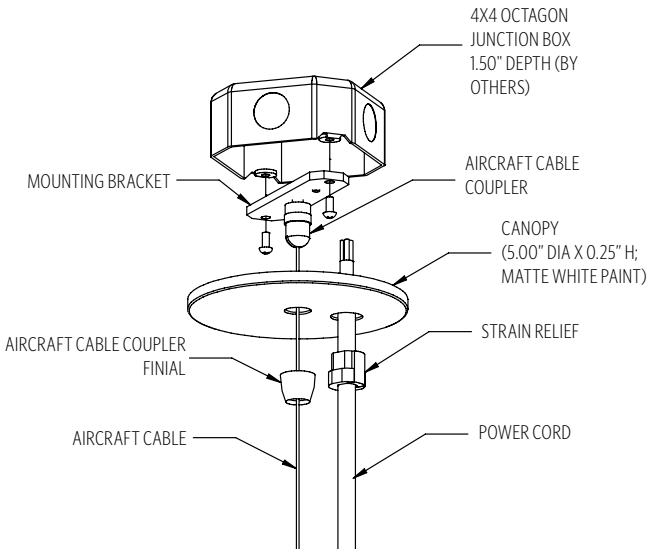
MODS, NOTES, & COMMENTS

This product meets the material restrictions of Article 4 of the RoHS Directive (2011/65/EU), including Commission Delegated Directive 2015/863

HANGING SYSTEM

P1EM PENDANT WITH VERTICAL AIRCRAFT CABLES TO SEPARATE MOUNTING POINTS AND POWER CORD TO CANOPY (REMOTE DRIVERS)



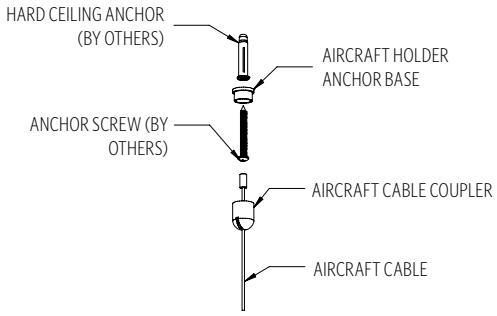


MOUNTING INFORMATION CHART

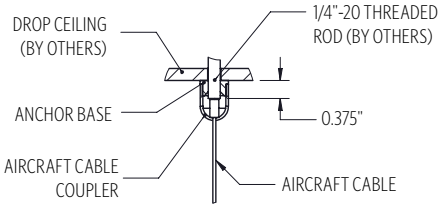
LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MOUNTING DISTANCE DIM A	MOUNTING CIRCLE DIM B	MOUNTING POINTS	MIN/MAX OAH
24"	23 LBS	10.67"	21.34"	4	12/144"
36"	31 LBS	16.67"	33.34"	4	12/144"
48"	41 LBS	22.67"	45.34"	4	12/144"
60"	50 LBS	28.67"	57.34"	4	12/144"
72"	58 LBS	34.67"	69.34"	4	12/144"

* P1EM ships with one of three OAH's (48", 100" or 144") and is field adjustable to the desired height.

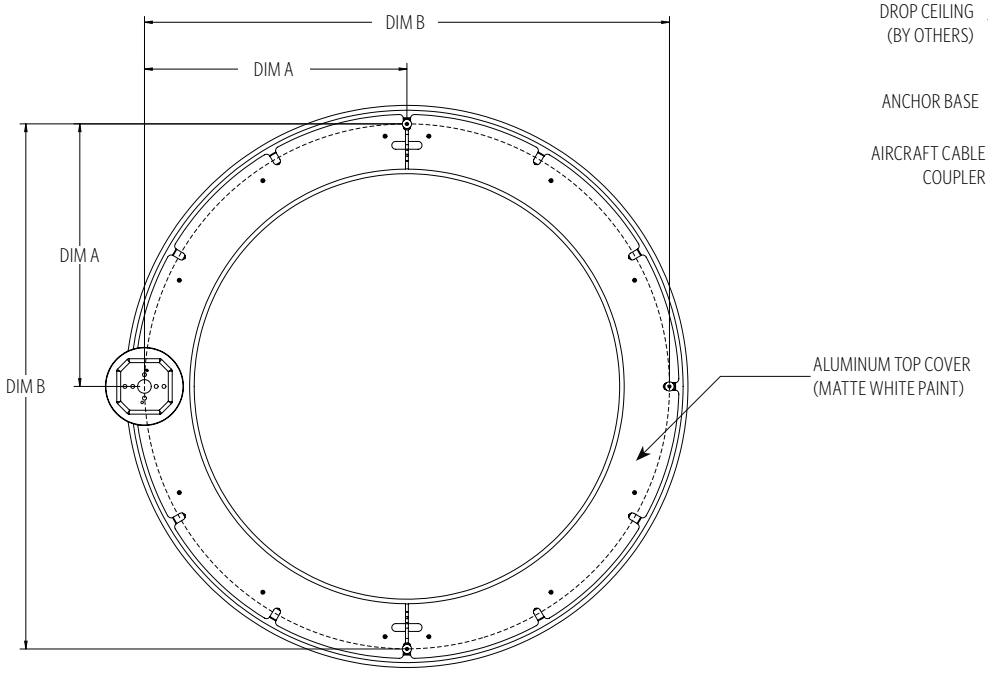
P1EM will include ETL listed enclosure for remote mounting drivers. Max 30' distance from luminaire for DM1 and 10' max remote distance for DM3. Enclosure must remain accessible after installation.



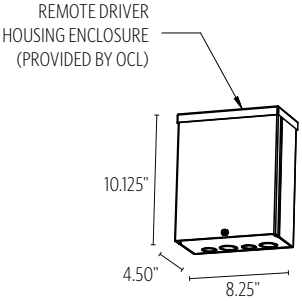
HARD CEILING



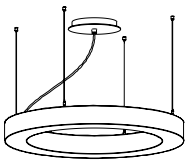
DROP CEILING

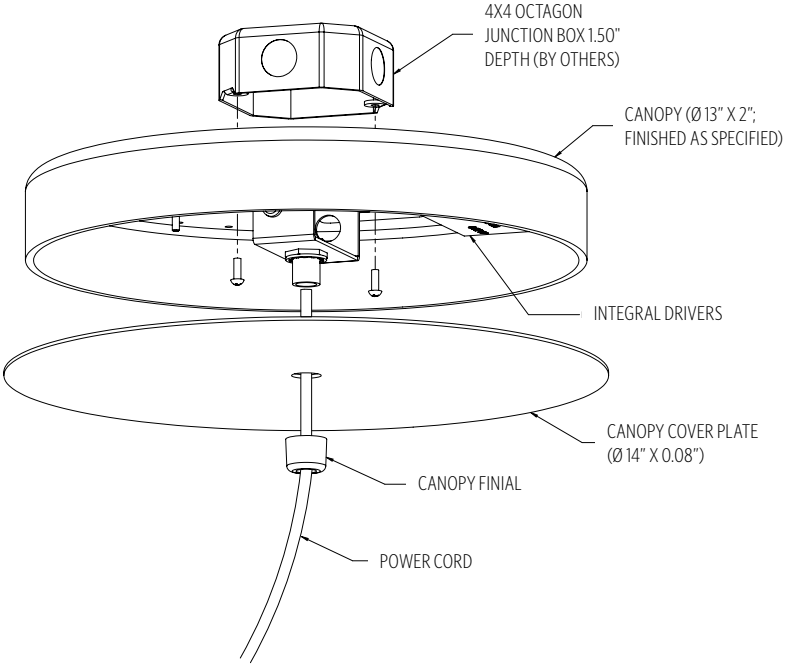


TOP VIEW



P1DA PENDANT WITH VERTICAL AIRCRAFT CABLES TO SEPARATE MOUNTING POINTS AND POWER CORD TO CANOPY WITH INTEGRAL DRIVER

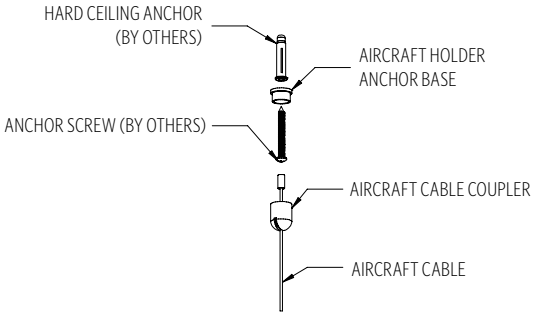




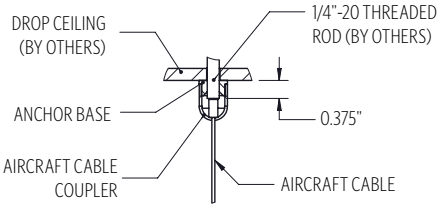
MOUNTING INFORMATION CHART

LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MOUNTING DISTANCE DIM A	MOUNTING CIRCLE DIM B	MOUNTING POINTS	MIN/MAX OAH
24"	23 LBS	10.67"	21.34"	4	12/144"
36"	31 LBS	16.67"	33.34"	4	12/144"
48"	41 LBS	22.67"	45.34"	4	12/144"
60"	50 LBS	28.67"	57.34"	4	12/144"
72"	58 LBS	34.67"	69.34"	4	12/144"

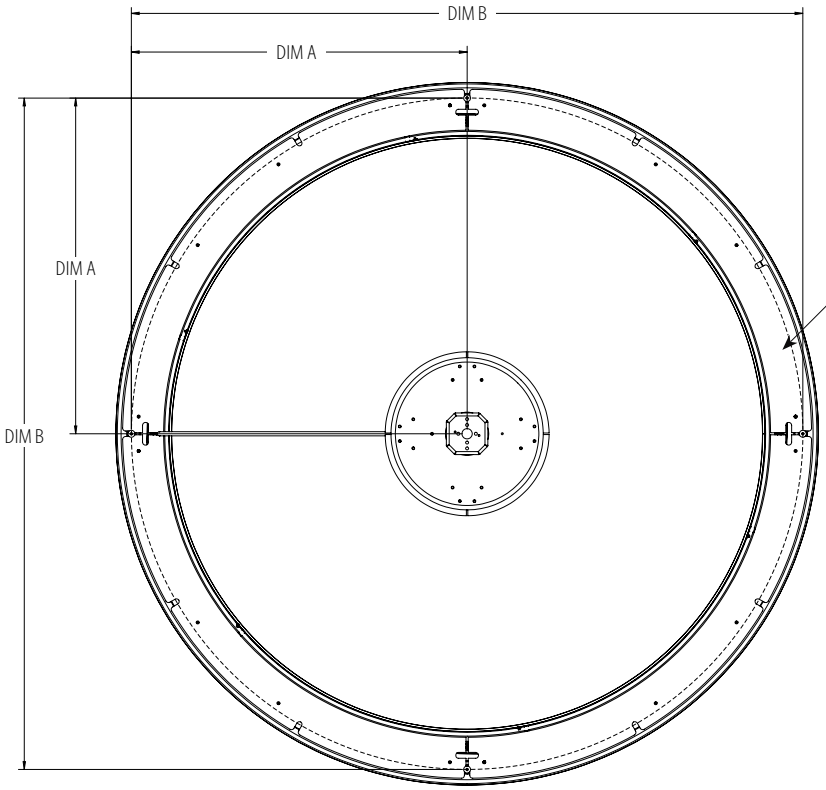
* P1DA ships with one of three OAH's (48", 100" or 144") and is field adjustable to the desired height.



HARD CEILING

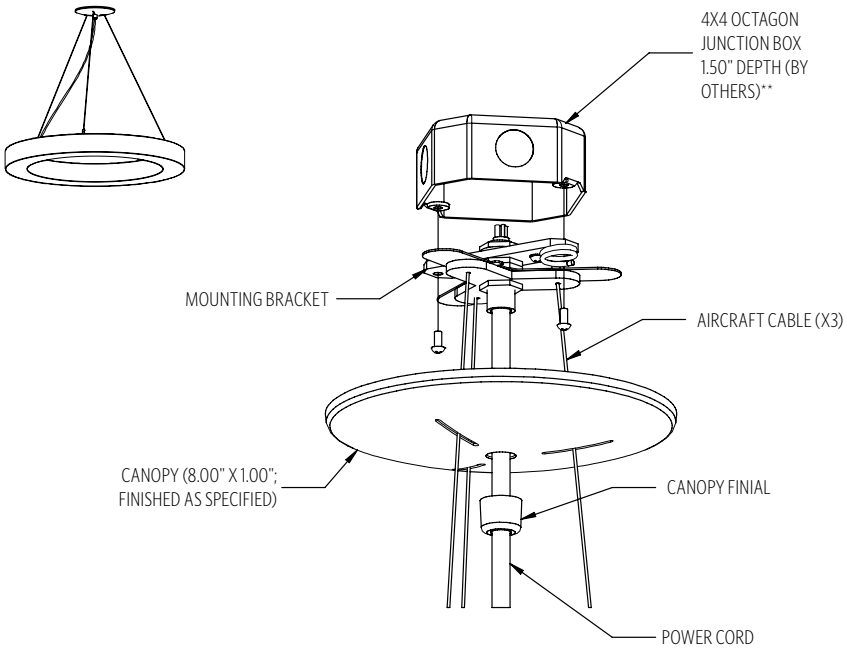


DROP CEILING



TOP VIEW

P1EC PENDANT WITH 3 ANGLED AIRCRAFT CABLES AND A POWER CORD TO CANOPY (REMOTE DRIVERS)



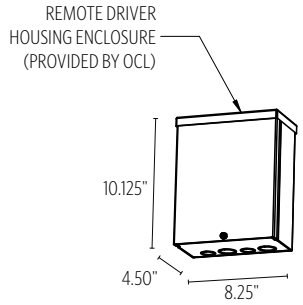
MOUNTING INFORMATION CHART

LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MOUNTING POINTS	MIN/MAX OAH
24"	23 LBS	1	24/144"
36"	31 LBS	1	24/144"
48"	41 LBS	1	30/144"
60"	50 LBS	1	36/144"
72"	58 LBS	1	36/144"

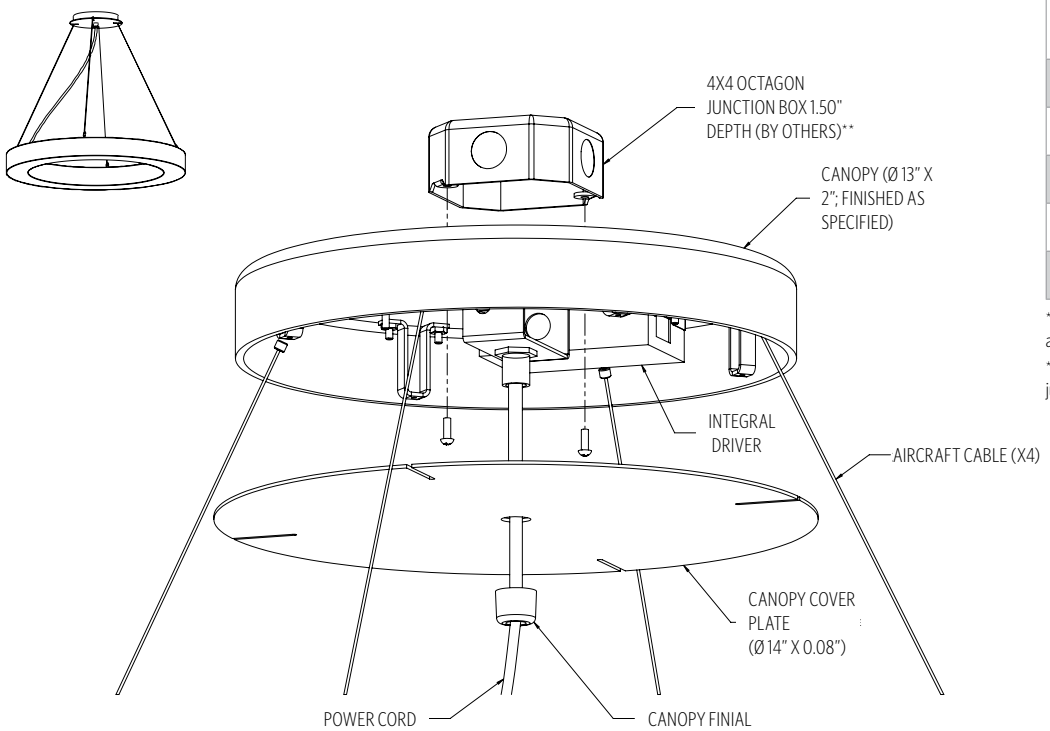
* P1EC ships with one of three OAH's (48", 100" or 144") and is field adjustable to the desired height.

**60" & 72" require structural mounting for the junction box for fixtures over 50 lbs.

P1EC will include ETL listed enclosure for remote mounting drivers. Max 30' distance from luminaire for DM1 and 10' max remote distance for DM3. Enclosure must remain accessible after installation.



P1DB PENDANT WITH ANGLED AIRCRAFT CABLES AND POWER CORD TO CANOPY WITH INTEGRAL DRIVER



MOUNTING INFORMATION CHART

LUMINAIRE DIAMETER	LUMINAIRE WEIGHT	MOUNTING POINTS	MIN/MAX OAH
24"	23 LBS	1	24/144"
36"	31 LBS	1	24/144"
48"	41 LBS	1	30/144"
60"	50 LBS	1	36/144"
72"	58 LBS	1	36/144"

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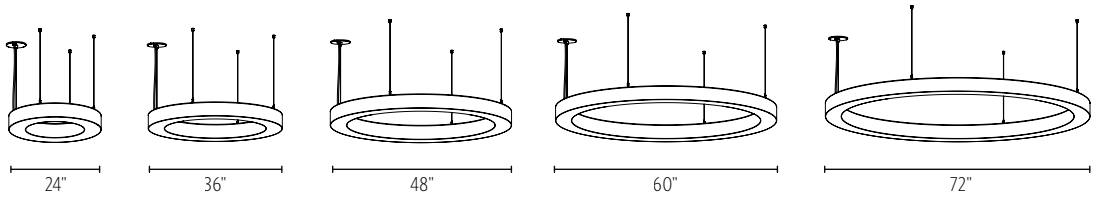
SIZES



DIFFUSER

ACRYLIC FINISHES:

MW
MATTE WHITE

FINISH

METALLIC POWDER COAT FINISHES:

SMP SILVER
GRP GRAPHITE
SGP STEEL GRAY
GLP GOLDTASTIC
BMP BRASS
BNP BRONZE

PREMIUM METAL FINISHES:

BAL
BRUSHED ALUMINUM

SOLID POWDER COAT FINISHES:

SWP SKY WHITE
MWP MATTE WHITE
BKP BLACK

TEXTURED POWDER COAT FINISHES:

BTP BLACK TEXTURED
WTP WHITE TEXTURED

RAL®, Pantone® or custom finishes are also available.

These colors are for reference only. Please be aware that colors may vary per monitor. Contact your local rep for finish samples or with any questions.

LIGHT SOURCE

		LUMENS AND WATTAGE CHART				
		24	**36**	**48**	**60**	**72**
LED1	LUMENS DELIVERED	3675	5775	7875	9975	12075
	SYSTEM WATTAGE	35	55	75	95	115
LED2	LUMENS DELIVERED	5115	7905	10695	13485	16275
	SYSTEM WATTAGE	55	85	115	145	175

This chart was created for a 35K color temp. Multiply by 0.95 for 27k color temp, 0.97 for 30k color temp, and 1.03 for 40k color temp. Lumens delivered shown for GL1 only. GL2, and GL3 will have approx. 30% reduction.

Values shown for 80+ CRI. For 90+ CRI lumens use 0.85 multiplier.

STANDARD COLOR TEMPERATURE OPTIONS	CRI (RA)	
2700K	80+	90+
3000K	80+	90+
3500K	80+	90+
4000K	80+	90+

LUMEN MAINTENANCE

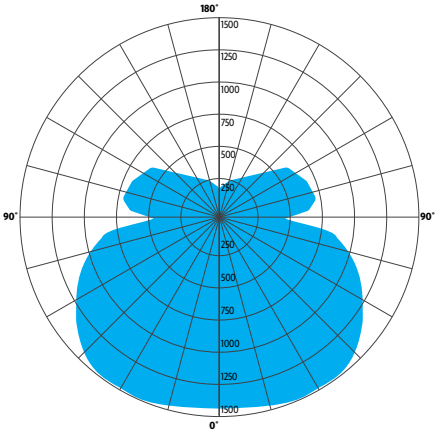
REPORTED:	L70 AT >60,000 HRS
CALCULATED:	L70 AT 182,000 HRS
REPORTED:	L90 AT 53,000 HRS
CALCULATED:	L90 AT 53,000 HRS

Derived from EPA TM-21 calculator. Based on typical conditions. Consult the factory for additional details.

PHOTOMETRY:

LUMINAIRE:	GL1-XXXX-48-MW-PTD-LED2/35K-UNV-XS
COLOR TEMP #:	3500K
OUTPUT:	10695
EFFICACY:	105 LM/W
TEST REPORT:	TEST NO. 19440.0

For all available IES files, please visit our website at ocl.com.



ZONE	LUMENS	% OF LUMINAIRE
0-30	1220	11%
0-60	4370	41%
0-90	7258	68%
90-180	3441	32%

Polar graph and zonal lumens shown for GL1 (GL2 and GL3 pending).

CONTROL

DM1 0-10V DIMMING 1%

- 0-10V DIMMING
- 1% MINIMUM DIM LEVEL
- ELECTRONIC DRIVER
- POWER FACTOR >0.9
- THD <20%
- MINIMUM AMBIENT OPERATING TEMPERATURE -22°F
- FIELD REPLACEABLE

DM3 LUTRON HI-LUME ECOSYSTEM 1% (LDE1)

- LUTRON HI-LUME SOFT-ON, FADE-TO-BLACK 1%, ECOSYSTEM, LDE1
- ELECTRONIC DRIVER
- POWER FACTOR >0.9
- THD <20%
- MINIMUM AMBIENT OPERATING TEMPERATURE: -32°F
- FIELD REPLACEABLE

OPTIONS

ULD DAMP LABEL LUMINAIRE

- MAY BE USED IN A OUTDOOR AREA THAT IS PROTECTED FROM DIRECT CONTACT WITH WIND, RAIN, SNOW OR EXCESSIVE MOISTURE

MOD MODIFIED LUMINAIRE

- LUMINAIRE IS MODIFIED FROM STANDARD OPTIONS; CONTACT LOCAL REP FOR MORE INFORMATION

BIOS

- **BIOS SKYBLUE™ DYNAMIC** LIGHT ENGINE IS DIMMABLE AND FEATURES A SIMPLE APPROACH TO CIRCADIAN LIGHTING CONTROLS.
- WHEN PAIRED WITH THE BIOS BIO-DIMMING MODULE, IT OPERATES USING ANY SINGLE CHANNEL CONSTANT CURRENT (CC) LED DRIVER AND CAN BE USED WITH ANY STANDARD DIMMING INTERFACE/PROTOCOL (0-10V, ELV, DMX, WIRELESS) AND COULD WORK WITH EXISTING TWO-CHANNEL CONTROL SYSTEMS AS WELL.
- VISIT **OCL.COM/BIOS** FOR MORE INFORMATION

SPECIFICATIONS

CONSTRUCTION

- DIFFUSER IS MOLDED IN ONE PIECE WITHOUT VISIBLE SEAMS OR JOINTS
- LED REFLECTOR ASSEMBLY IS ANODIZED ALUMINUM
- FIXTURE BODY HAS MATTE WHITE ALUMINUM TOP COVER
- HARDWARE IS ZINC PLATED OR STAINLESS STEEL

ELECTRICAL

- DIMMING ELECTRONIC DRIVER(S), COMES STANDARD WITH 0-10V DOWN TO 1%
- LUTRON (LDE1) ECOSYSTEM 1% ALSO AVAILABLE
- OCL PROPRIETARY LED ARRAYS USE NICHIA 757 DIODES
- 80+ CRI = 80 RA, R9 > 0 (10-15 TYP.)
- 90+ CRI = 90 RA, R9 > 50
- **FOR INTEGRAL DRIVERS:** LUMINAIRE CONNECTS TO BUILDING SUPPLY (120V-277V 50/60HZ)
- **FOR REMOTE DRIVERS:** LUMINAIRE WIRE LEADS ARE LOW-VOLTAGE. THE WIRES SHOULD BE CONNECTED TO OCL PROVIDED REMOTE DRIVER ENCLOSURE ONLY!

LISTING

- ETL LISTED TO UL 1598 FOR INDOOR, DRY LOCATION (DAMP LOCATION OPTIONAL)

WARRANTY

- 5 YEAR; ALL ELECTRICAL COMPONENTS RETAIN THE MANUFACTURER'S WARRANTY

SUSTAINABILITY

- THIS PRODUCT MEETS THE MATERIAL RESTRICTIONS OF ARTICLE 4 OF THE **ROHS** DIRECTIVE (2011/65/EU), INCLUDING COMMISSION DELEGATED DIRECTIVE 2015/863
- **BIOS** LIGHTING CONTRIBUTES TOWARD THE CIRCADIAN LIGHTING DESIGN FEATURE 54 UNDER THE **WELL BUILDING STANDARD™ V1** AND FEATURE L03 UNDER THE **WELL BUILDING STANDARD V2**

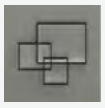
COMMON MODIFICATIONS

WE'RE BUILT FOR OUT-OF-THE-BOX THINKERS.

Nearly 50% of OCL fixtures we manufacture have some type of modification. Here is a list of common modifications we frequently produce. **Please contact the factory for modifications specific to your fixture or project**.

Need some help? Simply send your questions to us at **OCL-Quotes@ocl.com**

- BIOS, TUNABLE WHITE, WARM-DIM, & RGBW LIGHT SOURCES
- SPECIFIC LUMEN OUTPUT
- MODIFIED CLUSTERS OR CONFIGURATIONS / MULTI-DROP CANOPIES
- VARIOUS SHAPES, ARCS, AND CURVES FOR LINEAR PROFILES AND RINGS
- CEILING OR SURFACE MOUNTING
- LARGE SCALE MODIFICATIONS
- RAL, PANTONE, BRAND-SPECIFIC, RETIRED OCL COLOR, OR CUSTOM FINISHES



- EMERGENCY BATTERY BACKUP OR INVERTER OPTIONS
- REMOTE DRIVERS / EXTENDED DISTANCE REMOTE DRIVERS
- DIMMING TO 0.1% (DIM TO DARK)
- NON-STANDARD SIZES OR LENGTHS
- NON-STANDARD CANOPY, BODY AND/OR CORD COLORS
- SEISMIC AND/OR ANTI-SWAY SYSTEMS
- RIGID STEMS
- MODIFIED OVERALL HEIGHTS (LONGER OR SHORTER OAH)
- UPLIGHT ADDITIONS
- LASER ETCHING, ENGRAVING, AND CUTOUTS

ADVANCED HIGH CEILING

Signum 8 - Standard

METEOR

8-inch aperture high lumen with lumen output 3230 – 4220lm.

Quantity		Type	LT- 06
Project	Compton College - VAPA	Note	

Electrical System

- 4220lm (45W)
- Power Input: Universal (120-277V)
- Operating Temperature: -13°F~112°F
- Surge Protection: 2.5KV
- Power Factor Greater than 0.9
- Remote Emergency Pack: Bodine BSL20LV

LED Technology

- 2700K, 3000K, 3500K, 4000K, 5000K
- 85 CRI
- Beam Angle: 25°, 40°, 60°, 100°
- Rated Life > 60,000 Hours (L70)

Advanced Dimming

(Proprietary VX Driver is incorporated to all dimming options for video flicker-free lighting)

- Standard 0-10V dims to 10%
- DMX: high resolution dims to 0.1% (Supports ANSI E1.20 RDM protocol)
- Superior 0-10V: dims to 1%
- LTE: Hi-Lume 1% 2-wire LED Driver (120V forward phase only)
- LDE1: Hi-Lume 1% EcoSystem LED Driver with Soft-on, Fade-to-Black (UNV only)

Housing

- Diameter: 8.26" (210mm)
- Height: 9.25" (235mm)
- Material: Steel, Aluminum
- Weight: 11.02 lbs

Mounting

- Surface Mount
- Stem 2ft, 4ft; 37° Swivel Canopy Included
- Adjustable Aircraft Cable 10ft
- Wall Mount
- Yoke Mount

Warranty

- 5-year limited warranty

Listing

- ETL Dry Location Listed
- CE

ADVANCED HIGH CEILING

Signum 8 - Standard

How to Specify:

Ordering Example: SS8-45-358-UNV-SPV-40-BLK-AD10

4-5 weeks lead time on over 75% of specifications.

Model	Wattage	CCT / CRI	Voltage	Dimming
SS8			UNV	
SS8 Signum 8	45 45W	278 2700K / CRI85 308 3000K / CRI85 358 3500K / CRI85 408 4000K / CRI85 508 5000K / CRI85	UNV 120-277V	STV STV Standard 0-10V dims to 10% SPV Superior 0-10V dims to 1% DMX DMX dims to 0.1% (XLR Sockets) DMX(RJ45) DMX dims to 0.1% (RJ45 Sockets) LTE Hi-Lume 1% 2-wire LED Driver (120V forward phase only) LDE1 Hi-Lume 1% EcoSystem LED Driver with Soft-on, Fade-to-Black (UNV only)

Beam Angle	Finish	Mounting	Accessories
25 25º 40 40º 60 60º WD 100º	BLK Black WHT White	SUM Surface Mount ST2 Stem 2ft ST4 Stem 4ft AD10 Adjustable Aircraft Cable 10ft WLM Wall Mount YKM Yoke Mount	SPD[1] Surge Protector EMP Remote Emergency Pack [1] Surge protector for up to 10KV. Applicable for unstable mains or facilities using high power machineries

ADVANCED HIGH CEILING

Signum 8 - Standard

METEOR

Delivered Lumens*

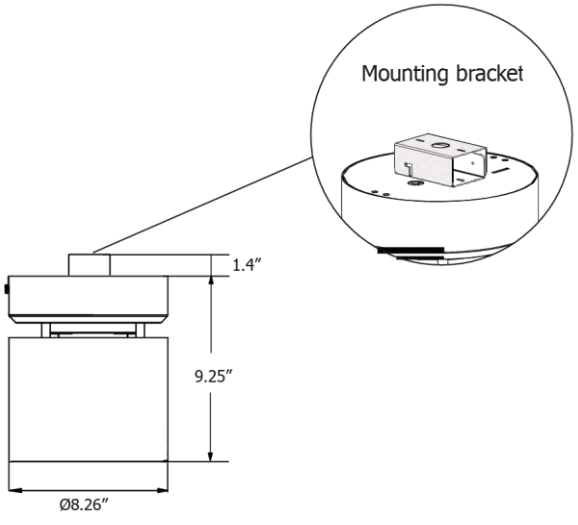
Wattage / CCT	SS8-45
	Beam Angle: 25°
5000K	4220 lm
4000K	3770 lm
3500K	3490 lm
3000K	3350 lm
2700K	3230 lm

*Tolerance± 8%

Current Consumption

Volt / Wattage	120V	277V
45W	0.47A	0.20A

Dimensions

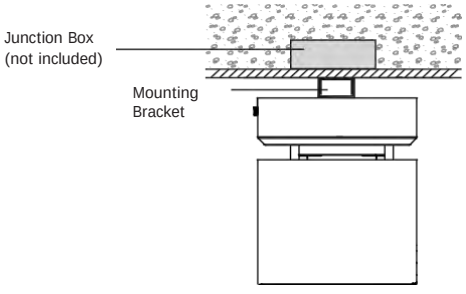


8-inch 45W

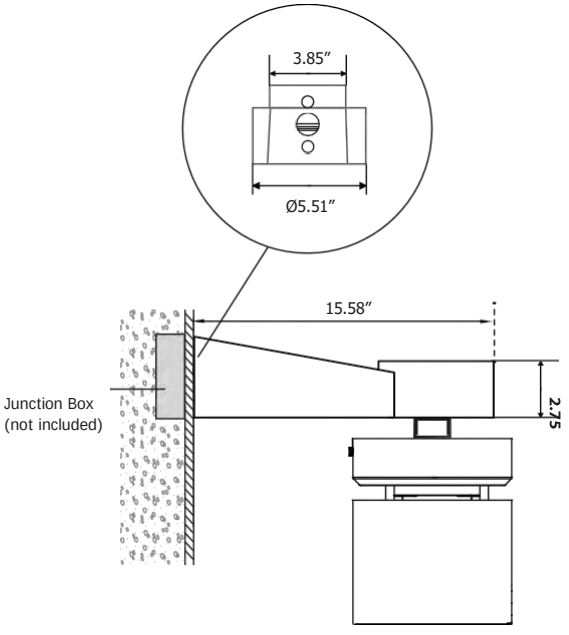
ADVANCED HIGH CEILING

Signum 8 - Standard

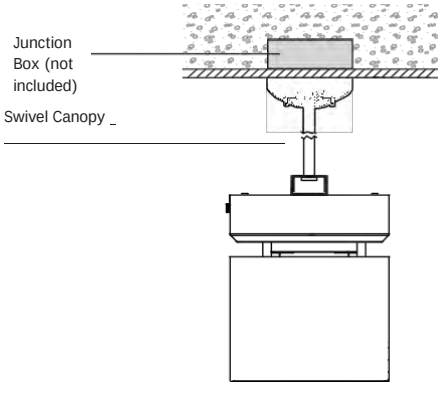
Mounting Options



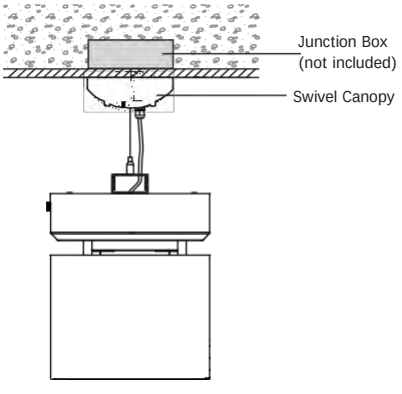
Surface Mount



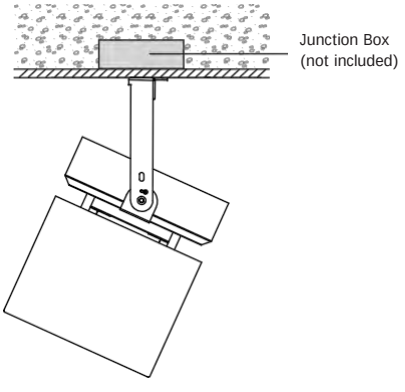
Wall Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

ADVANCED HIGH CEILING

Signum 8 - Standard

DMX Requirements*

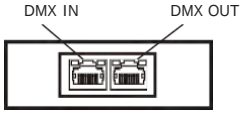
The Signum 8 LED fixture with DMX is a ONE CHANNEL DMX unit.

When placing order, please indicate DMX address. (The DMX address will be listed on the back of the fixture.)

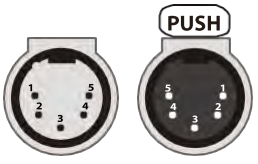
The LED fixture provide RJ45 Socket or XLR socket to connect. (DMX cable NOT included.)

The final fixture should be terminated by the use of DMX Terminator (by others).

RJ45 Sockets



XLR Sockets

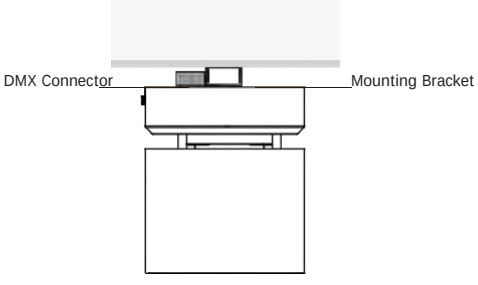


CONNECTION	RJ45 (CAT5e)	5-PIN XLR
Common	WHITE/BROWN(PIN7) & BROWN (PIN 8)	PIN 1
Signal -	ORANGE (PIN 2)	PIN 2
Signal +	WHITE/ORANGE (PIN 1)	PIN 3
Spare	-	PIN 4
Spare	-	PIN 5

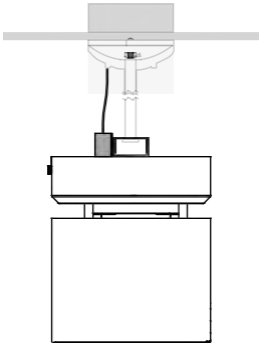
Compatible DMX Cabling List

DMX uses a cable consisting of two twisted pairs plus a shield to carry data. The cable must be specifically impedance matched for the digital DMX signal, meaning that microphone cable or other non-rated cable must not be used to carry DMX. Network cable (Cat5, 5e or 6 cable) may be used to carry DMX in an installation; however special consideration must be given to shielding and termination. Under no circumstances should solid core cable like Cat5 be terminated into a screw down connector.

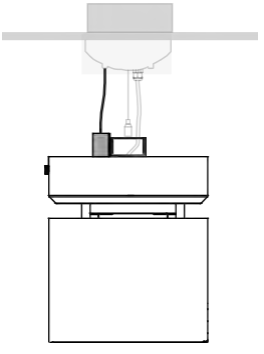
Meteor recommends the use of Belden 9729 for DMX installation. Belden 9729 is a two pair cable, which allows for a spare pair for 'out and back' type terminations if needed. Below is a list of other compatible Belden cables.



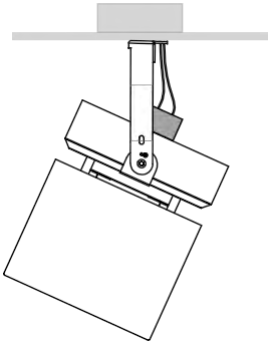
Surface Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

Compatible LTE Dimmer List

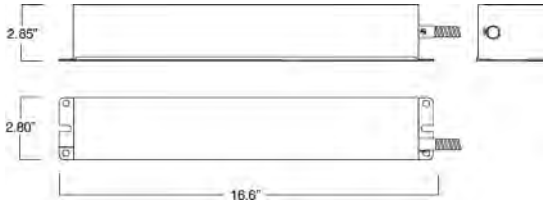
LUTRON PART NO.

RRD-6NA-	RRT-G5NEW-	RRT-GH	HQRD-10ND-	HQRT-GH	HQRD-HN	PD-10NXD-
RRD-6ND	RRT-G25LW-	HQRD-6NA-	MRF2-6ND-120-	HQRT-G25LW-	GT-250M-	PD-5NE-
RRD-10ND-	RRD-HN	HQRD-6ND-	MRF2S-6ND-120-	HQRT-G5NEW-	GTJ-250M-	

ADVANCED HIGH CEILING

Signum 8 - Standard

Remote Emergency Pack

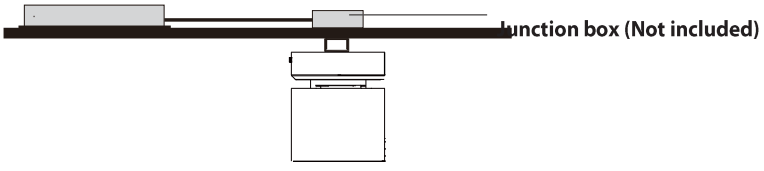


Emergency Pack Lumen Output Table

CCT	2700K	3000K	4000K	5000K
Lumen	1640 lm	1760 lm	1890 lm	1950 lm

Mounting with standard celling recessed Junction BOX

Emergency
Battery



Date: _____ Customer: _____

Project: Compton College - VAPA

Type: LT- 07 / LT-07A Qty: _____

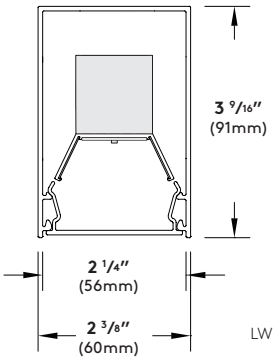
selux

M60
LED Direct

Order Code: L60 - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

L60	Series	**L60** M60 LED Direct	
_____	Light Engine	**1C45**[1,2,3] 80CRI-1018lm 90CRI-855lm 11.1W per foot **1C40**[1,2,3] 80CRI-954lm 90CRI-802lm 9.9W per foot **1C35**[1] 80CRI-834lm 90CRI-701lm 8.7W per foot **1C30**[1,2] 80CRI-746lm 90CRI-627lm 7.3W per foot **1C25**[1,2] 80CRI-594lm 90CRI-500lm 6.1W per foot **1C20**[1,2] 80CRI-494lm 90CRI-415lm 4.9W per foot	[1] Values calculated from a 4' fixture at 3500K, 90+ CRI using LW shielding and DIM driver. For additional information please see page 2. [2] Available starting at 2' and up. [3] Not available with Lutron.
_____	CCT	**927** 2700K 90+ CRI **930** 3000K 90+ CRI **935** 3500K 90+ CRI **940** 4000K 90+ CRI **827**[4] 2700K 80+ CRI **830**[4] 3000K 80+ CRI **835**[4] 3500K 80+ CRI **840**[4] 4000K 80+ CRI **RGBW** (consult factory)	[4] Consult factory for lead times
_____	Shielding	**LW** LED Optimized White Lens **MI** Clear Lens with Microprism **NB** LMO Symmetric with Satine Lens **A2** LMO Asymmetric 20° Wall Washer with Satine Lens **A5** LMO Asymmetric 5° Wall Grazer with Satine Lens **BW** LMO Batwing with Satine Lens	
_____	Mounting	**C** Cable **S** Swivel Stem **RS** Rigid Stem **W**[5] Wall Mount **F**[6] Surface Mount	[5] Consult factory for lengths under 2' [6] Over 8' supplied with 2 or more housings that are joined in the field.
_____	Nominal Fixture Length	**01*** 1 ft. **02** 2 ft. **03** 3 ft. **04** 4 ft. **05** 5 ft. **06** 6 ft. **07** 7 ft. **08** 8 ft. **09** 9 ft. **10** 10 ft. **11** 11 ft. **12** 12 ft. **XX** Runs (over 12') and Configurations, round up to the nearest foot and replace the "xx" with the # (i.e. 13=13' nominal) **1' fixture only available with 1C35 light engine.* *Individual fixtures, Runs and Configurations are supplied in nominal lengths to ensure full, even, illumination. See pages 2 through 6 for additional details.*	
_____	Finish	**WH*** White **BL** Semi-Matte Black **SV** Silver **SP** Specify Premium Color	** Custom colors are available, please consult factory*
_____	Voltage	**1** 120V **2** 277V **U** 120V through 277V 50/60hz capable **3**[7] 347V (consult factory)	[7] 347V not available with EM integral battery option
_____	Driver	**DIM**[8] 0-10V 1% (Linear) **DIL**[8,9] eldoLED 1% ECOdrive 0-10V (Logarithmic) **DED**[8,9] eldoLED 1% ECOdrive DALI-2 (Logarithmic) **D01**[8,9] eldoLED 0.1% SOLOdrive 0-10V (Linear) **DL01**[8,9] eldoLED 0.1% SOLOdrive 0-10V (Logarithmic) **DC2**[8,9,10] Lutron 1% 2-Wire **DE1**[8,9] Lutron 1% EcoSystem **DC3** Lutron 1% 3-Wire (consult factory)	[8] See page 7 for full details [9] Not available for 1' length or with [10] 120V only
_____	Fixture Options	**DL** Damp Location Rated **FS** In-line Fuse **SS**[11] Separate Switching	[11] See page 10 for details
_____	Sensor Options	**xE**[12,13] Enlighted **xS1**[12,13] Sensor Switch Daylight **xS2**[12,13] Sensor Switch Occ/Vac **xS3**[12,13] Sensor Switch Occ/Vac/ Daylight **xSN** nLight enabled (consult factory) **xV** Lutron Vive (consult factory) Replace "x" with quantity	[12] Minimum fixture length 2'. See page 10 for full details and restrictions [13] Requires DIM driver (0-10V)
_____	Emergency Options	**EC**[14,15] Emergency Circuit Wiring **EMR** Remote Micro Inverter (consult factory) **EM**[14,15,16] Integral EM battery pack	[14] See page 8 for full details and restrictions [15] For emergency options with sensors, please consult factory. [16] For EM available in 4' and ≥ 6'. Please consult factory for 5'.
_____	Configuration Options	**L9** Lit Horizontal 90° Corner **V9** Lit Inverted 90° Corner **T9** Lit "T" section **X9** Lit "X" section	* See page 12 for full details and restrictions

selux



LW lens shown for reference

Construction:

Housing - Continuous, low copper 6063-T6 extruded aluminum profile with aluminum endcaps, available as Individual fixtures (up to 12') or Runs.

Geartray - Low copper 6063-T6 extruded aluminum profile.

Shielding - Extruded, impact resistant acrylic lens:
- LED Optimized White Lens (LW)
- Clear Lens with Microprism (MI)

"LMO" refers to the Selux proprietary LED optical system - Light modulation optics. These lenses are offered in M60 behind a Satine Lens for even illumination and comfortable lit appearance.
- "LMO" Symmetric Lens (NB)
- "LMO" Asymmetric 20° Wall Washer (A2)
- "LMO" Asymmetric 5° Wall Grazer (A5)
- "LMO" Batwing (BW)

Mounting(s) - 1/16" Aircraft Cable, Ø5/8" Swivel or Rigid Steel Stem, Wall Bracket, Surface mounting (see pages 3 through 6 for details).
**Cable, Stem and Wall mountings may not be symmetrical for Runs and Configurations due to the use of modular housing lengths. If symmetrical suspensions are required please consult the factory.

Standard Luminaire lengths - All standard luminaires are supplied in nominal lengths to ensure full, even, illumination. Runs and Configurations are available in approximately ¼" increments starting at the nominal 12' fixture length.
**Individual luminaires are not joinable in the field.

Exact length luminaires - Individual luminaires, Runs, and Configurations are available in exact lengths to meet your project needs. Please consult factory with your requirements.
**Lens luminance may soften at the very ends of the straight sections for exact length luminaire.

L60 Joiner(s) - Runs and Configurations are supplied in multiple housings that are joined together in the field using the supplied L60 Joiner System. This allows ease of installation and ensures a uniform appearance (see page 9 for detail).

Weight: 2.4 lb. per foot.

Electrical/Performance:

LED Light Engine - Brand-name mid-power LEDs create a high efficiency LED light engine able to provide a lumen maintenance of 95% at 25,000 hours and 90% at 60,000 hours at 25°C per TM-21 reports. Reported L70 greater than 60,000 hours.

Photometrics - Consult website or factory for IES Files. Independent photometric lumen measurement complies with IES LM-79-08 testing procedures. Due to the LED manufacturer's tolerances, the listed output has a ±5% tolerance. For outputs based on different optics or CCT, please see page 13 for details.

CCT - Available in 2700K, 3000K, 3500K and 4000K, tolerance within a 3-step MacAdam ellipse.

CRI - 90+ and 80+ CRI. Consult factory for lead times of 80 CRI.

All Drivers - High efficiency, constant current, soft start, Electronic Class 2 with a PFC>0.90. For more detailed information on the available drivers please see page 7.

Sensors - Selux offers a variety of integral sensor options. For details and specifications, please refer to page 10.

Emergency - There are multiple emergency options available - Emergency Circuit, Remote Micro Inverter, and Integral EM Battery Pack. Please consult factory for use of sensors with emergency options. For more details on EC and EM options, see page 10.

Thermal Performance:

Ambient Operating Temperature - Luminaires suitable for maximum ambient temperature of 35°C (95°F) for all drivers.

Luminaires are suitable for minimum ambient temperatures of -40°C (-40°F) for DIM, DIL, DED, D01, and DL01 drivers; 0°C (32°F) for DC2 and DE1 drivers.

Luminaire Finish:

Powder Coat - All Selux luminaries are finished in high quality polyester powder coating in our Tiger Drylac certified facility and are tested in accordance with test specifications for coatings from ASTM and PCI.

All products undergo a five stage intensive pretreatment process where product is thoroughly cleaned, phosphated, and sealed. Selux powder coated products provide excellent salt and humidity resistance as well as ultra violet resistance for color retention.

Standard interior colors are White (WH), Semi-Matte Black (BL), and Silver (SV). Selux premium colors (SP) are available, please specify from your Selux color selection guide.

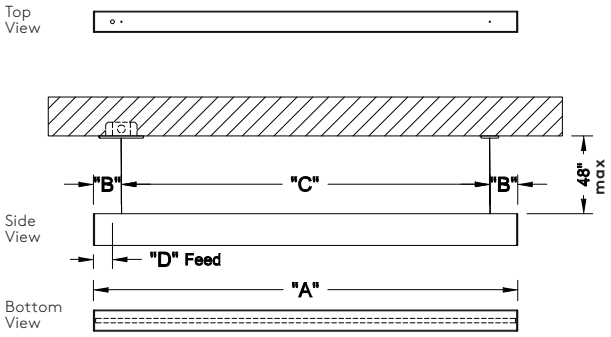
Warranty:

5 Year Limited LED Luminaire Warranty - Selux offers a 5 Year Limited Warranty to the original purchaser that the M60 series LED luminaire shall be free from defects in material and workmanship for up to five (5) years from date of shipment. This limited warranty covers the LED driver and LED light engine when installed according to Selux instructions and operated within the Ambient Temperature. For additional details and exclusions, see "Selux Terms and Condition of Sale."

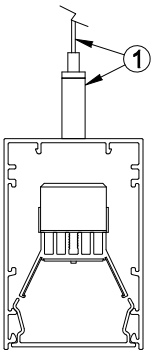
Certifications and Compliance:

NRTL - For Dry and Damp location
(I.E. cULus; cCSAus)
ADA Compliant
ARRA Compliant
RoHS Compliant

Cable Mounting (C)



Cable Mounting (C)

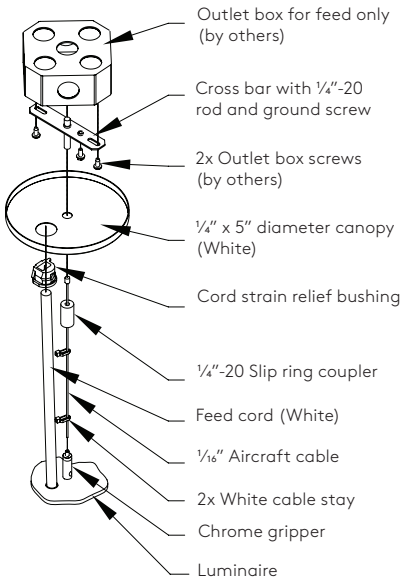


1. Ø 1⁄16" Aircraft Cable with chrome gripper for easy adjustment (48" max. from ceiling to luminaire).

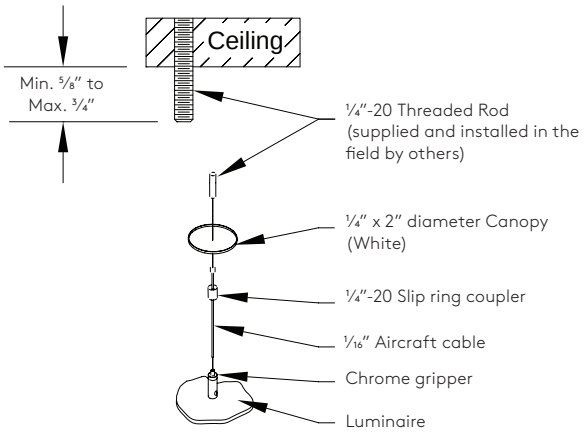
Cable Mounting (C) - Dimensions								
Nominal Length	**"A" Housing Length**		*** "B" (Ref.) End Suspensions**		**"C" Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1ft.)	1' - 1⁄4"	311	0' - 2 1⁄8"	54	0' - 8"	203	0' - 1 1⁄8"	29
02 (2ft.)	2' - 1⁄4"	616	0' - 2 1⁄8"	54	1' - 8"	508	0' - 1 1⁄8"	29
03 (3ft.)	3' - 1⁄4"	921	0' - 3 1⁄8"	79	2' - 6"	762	0' - 2 1⁄8"	54
04 (4ft.)	4' - 1⁄4"	1226	0' - 3 1⁄8"	79	3' - 6"	1067	0' - 2 1⁄8"	54
05 (5ft.)	5' - 1⁄4"	1530	0' - 3 1⁄8"	79	4' - 6"	1372	0' - 2 1⁄8"	54
06 (6ft.)	6' - 1⁄4"	1835	0' - 3 1⁄8"	79	5' - 6"	1676	0' - 2 1⁄8"	54
07 (7ft.)	7' - 1⁄4"	2140	0' - 3 1⁄8"	79	6' - 6"	1981	0' - 2 1⁄8"	54
08 (8ft.)	8' - 1⁄4"	2445	0' - 3 1⁄8"	79	7' - 6"	2286	0' - 2 1⁄8"	54
09 (9ft.)	9' - 1⁄4"	2750	0' - 3 1⁄8"	79	8' - 6"	2591	0' - 2 1⁄8"	54
10 (10ft.)	10' - 1⁄4"	3054	0' - 3 1⁄8"	79	9' - 6"	2896	0' - 2 1⁄8"	54
11 (11ft.)	11' - 1⁄4"	3359	0' - 3 1⁄8"	79	10' - 6"	3200	0' - 2 1⁄8"	54
12 (12ft.)	12' - 1⁄4"	3664	0' - 3 1⁄8"	79	11' - 6"	3505	0' - 2 1⁄8"	54

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

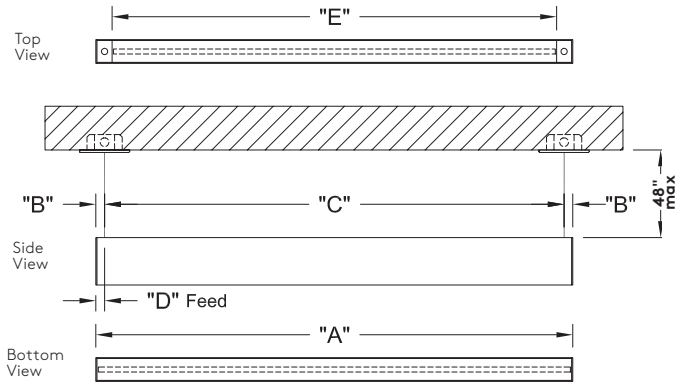
L60 Cable (C) Suspension Detail
(Feed location(s) only)



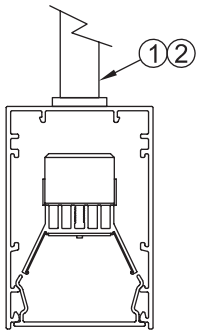
L60 Cable (C) Suspension Detail
(Non-Feed location(s) only)



Stem Mounting (S and RS)



Stem Mounting (S and RS)

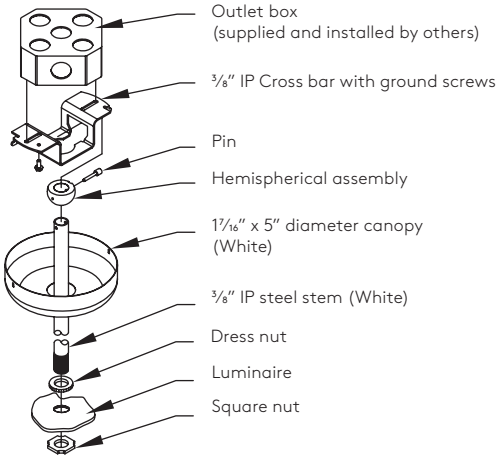


1. Ø ⅝" Swivel Stem provides 30° swivel and **can be cut in field** (48" max. from ceiling to luminaire).
2. Ø ⅝" Rigid Stem is fixed and is **not able to be cut/adjusted in field** (48" max. from ceiling to luminaire).

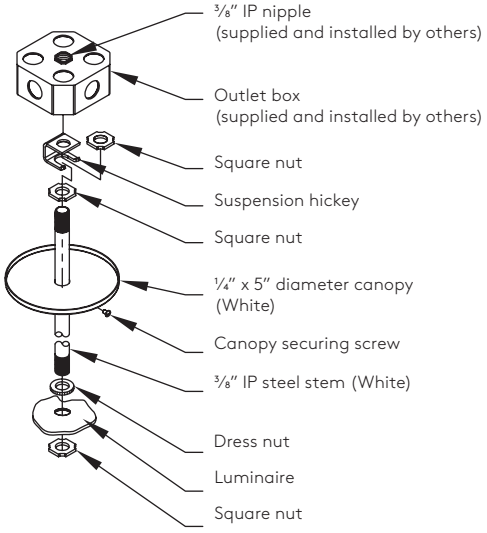
Swivel (S) & Rigid Stem (RS) Mountings - Dimensions								
Nominal Length	**"A" Housing Length**		*** "B" (Ref.) End Suspensions**		**"C" Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1ft.)	1' - ¼"	311	0' - 2 ⅛"	54	0' - 8"	203	0' - 2 ⅛"	54
02 (2ft.)	2' - ¼"	616	0' - 2 ⅛"	54	1' - 8"	508	0' - 2 ⅛"	54
03 (3ft.)	3' - ¼"	921	0' - 3 ⅛"	79	2' - 6"	762	0' - 3 ⅛"	79
04 (4ft.)	4' - ¼"	1226	0' - 3 ⅛"	79	3' - 6"	1067	0' - 3 ⅛"	79
05 (5ft.)	5' - ¼"	1530	0' - 3 ⅛"	79	4' - 6"	1372	0' - 3 ⅛"	79
06 (6ft.)	6' - ¼"	1835	0' - 3 ⅛"	79	5' - 6"	1676	0' - 3 ⅛"	79
07 (7ft.)	7' - ¼"	2140	0' - 3 ⅛"	79	6' - 6"	1981	0' - 3 ⅛"	79
08 (8ft.)	8' - ¼"	2445	0' - 3 ⅛"	79	7' - 6"	2286	0' - 3 ⅛"	79
09 (9ft.)	9' - ¼"	2750	0' - 3 ⅛"	79	8' - 6"	2591	0' - 3 ⅛"	79
10 (10ft.)	10' - ¼"	3054	0' - 3 ⅛"	79	9' - 6"	2896	0' - 3 ⅛"	79
11 (11ft.)	11' - ¼"	3359	0' - 3 ⅛"	79	10' - 6"	3200	0' - 3 ⅛"	79
12 (12ft.)	12' - ¼"	3664	0' - 3 ⅛"	79	11' - 6"	3505	0' - 3 ⅛"	79

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

L60 Swivel Stem (S) Suspension Detail
(feed wires through stem supplied by Selux)

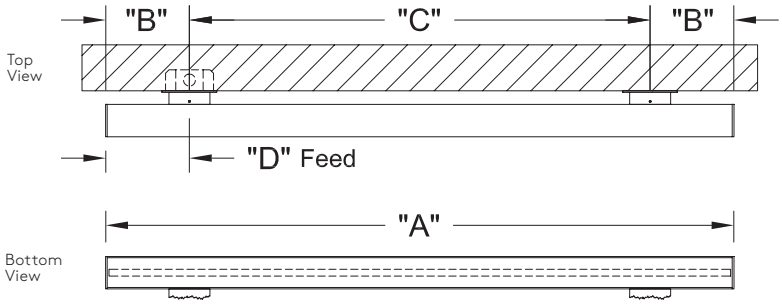


L60 Rigid Stem (RS) Suspension Detail
(feed wires through stem supplied by Selux)



Wall Mounting (W)

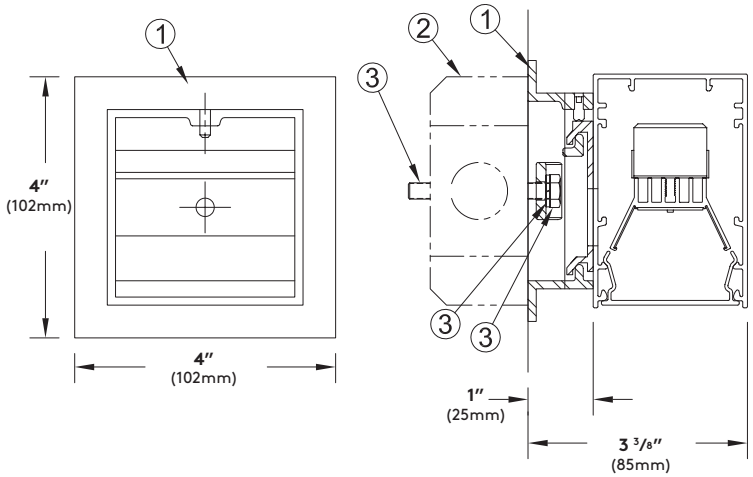
For patterns and configurations that include a wall mount, please see page 12 for details



Wall (W) Mount - Dimensions								
Nominal Length	**"A" Housing Length**		*** "B" (Ref.) End Suspensions**		**"C" Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1 ft.)	1' - ¼"	311	6 ⅛"	156	N/A		0 - 6 ⅛"	156
02 (2 ft.)	2' - ¼"	616	3 ⅛"	79	1' - 0"	458	0 - 3 ⅛"	79
03 (3 ft.)	3' - ¼"	921	6 ⅛"	156	2' - 6"	610	0 - 6 ⅛"	156
04 (4 ft.)	4' - ¼"	1226	6 ⅛"	156	3' - 0"	914	0 - 6 ⅛"	156
05 (5 ft.)	5' - ¼"	1530	6 ⅛"	156	4' - 0"	1219	0 - 6 ⅛"	156
06 (6 ft.)	6' - ¼"	1835	6 ⅛"	156	5' - 0"	1524	0 - 6 ⅛"	156
07 (7 ft.)	7' - ¼"	2140	6 ⅛"	156	6' - 0"	1829	0 - 6 ⅛"	156
08 (8 ft.)	8' - ¼"	2445	6 ⅛"	156	7' - 0"	2134	0 - 6 ⅛"	156
09 (9 ft.)	9' - ¼"	2750	6 ⅛"	156	8' - 0"	2438	0 - 6 ⅛"	156
10 (10 ft.)	10' - ¼"	3054	6 ⅛"	156	9' - 0"	2743	0 - 6 ⅛"	156
11 (11 ft.)	11' - ¼"	3359	6 ⅛"	156	10' - 0"	3048	0 - 6 ⅛"	156
12 (12 ft.)	12' - ¼"	3664	6 ⅛"	156	11' - 0"	3353	0 - 6 ⅛"	156

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

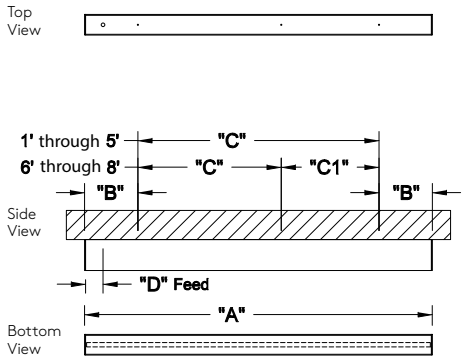
Wall Mount (W)
(Covers a 4x4 or 2x4 J-box)



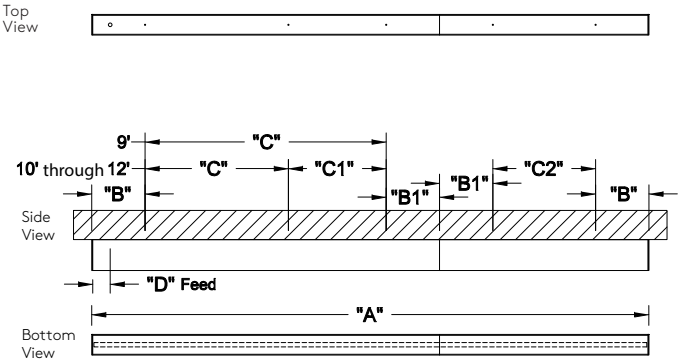
1. Aluminum wall bracket (by Selux).
2. 4"x4" or 2"x4" J-box at feed location (supplied and installed by others).
3. ¼"-20 Threaded rod, ¼"-20 lock washer and ¼"-20 nut required to anchor the wall bracket. Mounting hardware supplied and installed to code by others.

selux

Surface Mounting (F) - 1′ to 8′



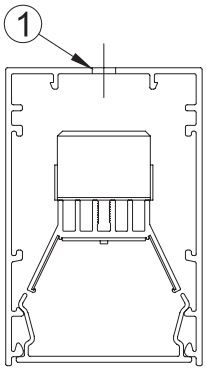
Surface Mounting (F) - Over 9′ to 12′



Surface Mount (FF, F2, & F4) - Dimensions														
Nominal Length	**"A" Housing Length**		*** "B" (Ref.) End Suspensions**		*** "B1" End Suspensions**		**"C" Mid. Suspension**		**"C1" Mid. Suspension**		**"C2" Mid. Suspension**		**"D" Feed Location**	
	Feet/Inch	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**	**Feet/Inch**	**MM**
01 (1 ft.)	1' - ¼"	311	- 1 ⅝"	41	N/A		0' - 9"	229	N/A		N/A		0' - 4 ⅛"	105
02 (2 ft.)	2' - ¼"	616	0' - 1 ⅝"	41	N/A		1' - 9"	533	N/A		N/A		0' - 4 ⅛"	105
03 (3 ft.)	3' - ¼"	921	0' - 6 ⅛"	156	N/A		2' - 0"	610	N/A		N/A		0' - 2 ⅛"	54
04 (4 ft.)	4' - ¼"	1226	0' - 6 ⅛"	156	N/A		3' - 0"	914	N/A		N/A		0' - 2 ⅛"	54
05 (5 ft.)	5' - ¼"	1530	0' - 6 ⅛"	156	N/A		4' - 0"	1219	N/A		N/A		0' - 2 ⅛"	54
06 (6 ft.)	6' - ¼"	1835	0' - 6 ⅛"	156	N/A		3' - 0"	914	2' - 0"	610	N/A		0' - 2 ⅛"	54
07 (7 ft.)	7' - ¼"	2140	0' - 6 ⅛"	156	N/A		3' - 0"	914	3' - 0"	914	N/A		0' - 2 ⅛"	54
08 (8 ft.)	8' - ¼"	2445	0' - 6 ⅛"	156	N/A		3' - 0"	914	4' - 0"	1219	N/A		0' - 2 ⅛"	54
09 (9 ft.)	9' - ¼"	2750	0' - 6 ⅛"	156	0' - 6"	152	4' - 0"	1219	N/A		3' - 0"	914	0' - 2 ⅛"	54
10 (10 ft.)	10' - ¼"	3054	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	2' - 0"	610	3' - 0"	914	0' - 2 ⅛"	54
11 (11 ft.)	11' - ¼"	3359	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	3' - 0"	914	3' - 0"	914	0' - 2 ⅛"	54
12 (12 ft.)	12' - ¼"	3664	0' - 6 ⅛"	156	0' - 6"	152	3' - 0"	914	4' - 0"	1219	3' - 0"	914	0' - 2 ⅛"	54

*Dimension(s) rounded to the nearest 1/16" with a ± 1/16" (1mm) tolerance.

Surface Mount (F)



***Please note: Fixture does not cover a 4x4 J-box**

1. Ø 5/16" Mounting hole drilled at the factory (mounting hardware to code by others).

0-10V linear dimming (DIM)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for linear dimming curve. Fixtures ship wired for dimming. For on/off functionality, simply cap the dimming leads. Minimum dimming level preset at factory to 1%. (Due to size constraints, 1' luminaires are supplied with a driver from a different manufacturer than 2' and above luminaires. For details, please consult factory).

0-10V logarithmic eldoLED ECOdrive dimming (DIL)
Luminaires supplied with drivers offering the capability of either normal switched operation of 0-10V dimming for logarithmic dimming curve, Fixtures shipped wired for dimming. For on/off functionality, simply cap the dimming leades. Minimum dimming level preset at factory to 1%.

eldoLED ECOdrive DALI-2 dimming (DED)
Luminaires supplied with ECOdrive DALI-2 dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 1%. For "dim to dark" (down to 0.1%), please consult factory.

eldoLED SOLOdrive 0-10V linear dimming (D01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with linear dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

eldoLED SOLOdrive 0-10V logarithmic dimming (DL01)
Luminaires supplied with SOLOdrive 0-10V dimming driver with logarithmic dimming curve. Minimum dimming level preset at factory to 0.1% and "dim to dark".

LUTRON 2-wire dimming (DC2)
Luminaires supplied with Hi-Lume 2-wire dimming driver (120V only) programmed for Constant Current Reduction (CCR). For Pulse Width Modulation (PWM) dimming, please consult factory. Minimum dimming level down to 1%.

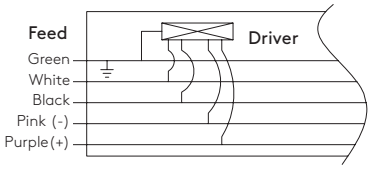
LUTRON EcoSystem dimming (DE1)
Luminaires supplied with Hi-Lume EcoSystem (4 wire, digital link) dimming driver programmed for Constant Current Reduction (CCR). Minimum dimming level down to 1% with SoftOn/FadeToBlack.

* For control recommendations, please contact driver manufacturer.

<table>
<tr><td colspan="13">Driver Quantity</td></tr>
<tr><td rowspan="2">Light Engine</td><td rowspan="2">Dimming Code</td><td colspan="11">Length</td></tr>
<tr><td>1ft</td><td>2ft</td><td>3ft</td><td>4ft</td><td>5ft</td><td>6ft</td><td>7ft</td><td>8ft</td><td>9ft</td><td>10ft</td><td>11ft</td><td>12ft</td></tr>
<tr><td rowspan="4">1C20</td><td>DIM/DIL</td><td rowspan="13">N/A</td><td colspan="7" rowspan="3">1</td><td rowspan="2">2</td><td colspan="2" rowspan="2">2</td><td rowspan="2">1</td></tr>
<tr><td>D01/DL01/DED</td></tr>
<tr><td>DE1</td></tr>
<tr><td>DC2</td><td>3</td><td colspan="2">3</td><td>2</td></tr>
<tr><td rowspan="4">1C25</td><td>DIM/DIL</td><td colspan="6" rowspan="3">1</td><td rowspan="2">1</td><td rowspan="2">2</td><td colspan="2" rowspan="2">2</td><td rowspan="2">1</td></tr>
<tr><td>D01/DL01/DED</td></tr>
<tr><td>DE1</td></tr>
<tr><td>DC2</td><td colspan="2">2</td><td>3</td><td colspan="2">3</td><td>2</td></tr>
<tr><td rowspan="4">1C30</td><td>DIM/DIL</td><td colspan="5" rowspan="3">1</td><td colspan="3" rowspan="2">1</td><td rowspan="2">2</td><td colspan="2" rowspan="2">2</td><td rowspan="2">2</td></tr>
<tr><td>D01/DL01/DED</td></tr>
<tr><td>DE1</td></tr>
<tr><td>DC2</td><td colspan="3">2</td><td>3</td><td colspan="2">3</td><td>3</td></tr>
<tr><td rowspan="4">1C35</td><td>DIM/DIL</td><td>1</td><td colspan="5" rowspan="3">1</td><td rowspan="2">1</td><td>2</td><td rowspan="3">1</td><td rowspan="3">2</td><td colspan="2" rowspan="3">2</td><td rowspan="3">2</td></tr>
<tr><td>D01/DL01/DED</td><td rowspan="11"></td><td>1</td></tr>
<tr><td>DE1</td><td>2</td></tr>
<tr><td>DC2</td><td colspan="2">2</td><td>2</td><td>3</td><td colspan="2">3</td><td>3</td></tr>
<tr><td rowspan="4">1C40</td><td>DIM/DIL</td><td colspan="5" rowspan="2">1</td><td rowspan="2">1</td><td>2</td><td colspan="3" rowspan="2">2</td><td colspan="2" rowspan="2">3</td></tr>
<tr><td>D01/DL01/DED</td><td>1</td></tr>
<tr><td>DE1</td><td colspan="9">N/A</td></tr>
<tr><td>DC2</td></tr>
<tr><td rowspan="4">1C45</td><td>DIM/DIL</td><td colspan="4" rowspan="2">1</td><td>2</td><td rowspan="2">1</td><td colspan="2" rowspan="2">2</td><td rowspan="2">3</td><td rowspan="2">2</td><td colspan="2" rowspan="2">3</td></tr>
<tr><td>D01/DL01/DED</td><td>1</td></tr>
<tr><td>DE1</td><td colspan="9">N/A</td></tr>
<tr><td>DC2</td></tr>
</table>

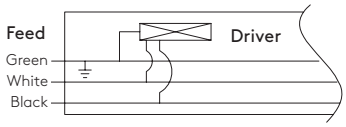
Wiring Diagrams

0-10V linear (DIM)
0-10V logarithmic eldoLED ECOdrive (DIL)
DALI-2 logarithmic eldoLED ECOdrive (DED)
0-10V linear eldoLED SOLOdrive (D01)
0-10V logarithmic eldoLED SOLOdrive (DL01)

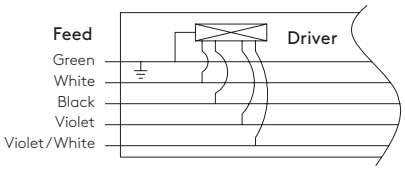


Standard Wiring supplied for all drivers	Green = Ground White = Neutral (120V/277V/347V) or L2 (240V) Black = Hot/L1 (120V-347V)
- The following wire(s) are in addition to the standard above -	
DIM, DIL, DED, D01, DL01	Pink = (-) DALI-2 or 0-10V Dimming Control Purple = (+) DALI-2 or 0-10V Dimming Control
DC2	No additional wires
DE1	Violet = "E1" Digital Link Dimming Control Violet/White = "E2" Digital Link Dimming Control

Lutron 2-Wire (DC2)

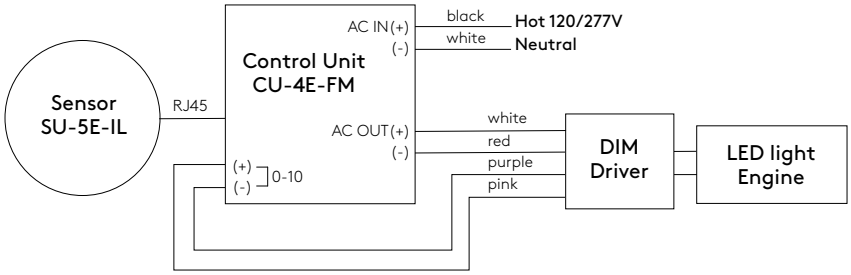


Lutron EcoSystem (DE1)

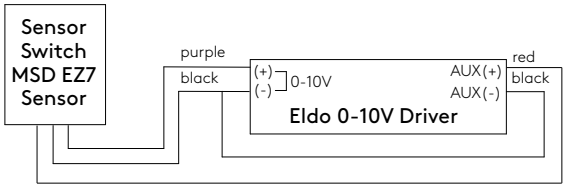


Sensor Wiring Diagrams

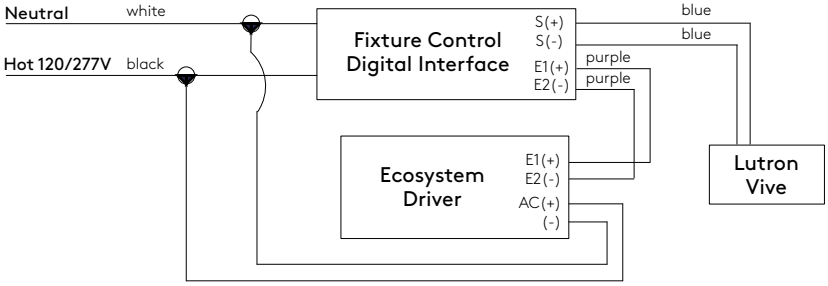
Enlighted



Sensor Switch



Lutron Vive



Driver power chart - use below values to determine the nominal watts per foot based on driver, light engine, and voltage.
* Driver losses increase the wattage for fixtures less than 4 foot.
** Values are nominal values determined based on multiple tested fixtures.

Driver Power Usage				
Driver	**Light Engine**	**Nominal W/ft**		
		120V	**277V**	**347V**
DIM, DIL, DED, D01, DL01	1C20	4.9	5.3	n/a
	1C25	6.1	6.5	
	1C30	7.3	7.7	
	1C35	8.7	8.9	
	1C40	9.9	10.1	
	1C45	11.1	11.3	
DC2, DE1, DCE, DC3	1C20	5.5	5.2	n/a
	1C25	6.7	6.3	
	1C30	8.0	7.6	
	1C35	9.3	8.8	
	1C40	10.6	10.0	
	1C45	11.6	11.3	
DIM @347V	1C20	n/a	n/a	5.4
	1C25			6.5
	1C30			7.7
	1C35			8.8
	1C40			10.0
	1C45			11.2
EM	all	6		n/a

Fuse (FS) - Fusing, luminaires supplied with a in-line fuse located on the hot wire for each feed (Supplied with an 8A slow burn fuse).

Damp Location (DL) - Luminaires are suitable for use in damp location(s). Examples of such locations include protected areas under canopies, marquees, roofed porches, and similar locations where the fixture(s) are protected from direct contact with rain, snow, or excessive moisture (such as ocean spray). Interior locations include areas subject to moderate degrees of moisture, such as basements and certain barns and cold storage buildings.

*For Damp Location with sensors, please consult factory.

Separate Switching (SS) - Luminaires available with separately switched 4' (nominal) sections starting at 7' and up. Luminaire is intended to be wired to the same panel/breaker (not intended for Emergency use).

*All separately switched (non-EM) circuits within an individual luminaire, linear run, or configuration must be connected to the same branch circuit on-site.

*To specify this option, the number of separately switched sections and locations of these sections must be provided at time of order.

*If the project requires different separate switching than outlined above please consult the factory.

*For Separate Switching with sensors, please consult factory.

Emergency Wiring (EC) - EC luminaires are intended to be wired to separate panels/breakers for emergency use. See install instructions for proper wiring.

For 1' to 6' nominal luminaires, the entire fixture is wired for operation on emergency circuit.

For 7' and up nominal luminaires, the first 4' nominal length is wired for operation by a separate EM circuit by default to meet the required "Life Safety Code" (NFPA 101).

If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Emergency Battery (EM) – The EM battery is located integral to fixture and is factory pre-wired. See install instructions for proper wiring.

10W constant power Emergency Battery Pack.

Direct fixtures are available for emergency battery (EM) use in 4' and ≥6. Due to size constraints, EM is not available in 5' fixtures.

For individual fixtures, emergency option will illuminate the first 4' section of fixture. For continuous runs, please consult factory to advise on 4' section intended for emergency use. For fixtures >12' or if a different configuration is needed, please consult factory.

Emergency test switch is located next to the geartray, behind the lens.

* Emergency battery option is UNV for use with 120V or 277V and is not available for 347V.

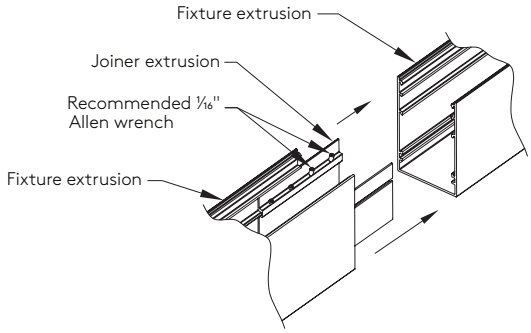
* Please note battery pack requires an unswitched hot.

* For EM with sensors, please consult factory.

* If a different configuration is needed, please consult factory.

Note: Wiring may vary slightly due to on-site conditions or local codes. Please follow all safety installation protocols contained within install instructions when installing luminaire.

Joiner System - standard for Runs and Configurations



Sensor Ordering Chart		
Quantity	**Sensor**	**Settings***
x Number of Sensors	**E** Enlighted SU-5E-IL **S** Sensor Switch MSD EZ **V** Lutron Vive DFCSJ	**1** Daylight **2** Occupancy/Vacancy **3** Daylight/Occupancy/Vacancy * Settings not available with Enlighted

Enlighted SU-5E-IL (E)
Enlighted Micro Sensor SU-5E-IL (Independent Lighting) provided as standard with an Enlighted CU-4E-FM Fixture Mount Control Unit integral to fixture. If SU-5E-CL (Connected Lighting) or SU-5E-IoT (Internet of Things) is desired, please contact factory. Occupancy/vacancy, thermal, daylight sensing plus Tunable White, Room & Zone control, Internet of Things (IoT) data collection and reporting control. For full details, please see SU-5E-(IoT/CL/IL) spec sheet on the Enlighted website. Must be paired with a 0-10V driver with auxiliary (DIM driver selection). Commissioning by Enlighted.

*Sensor can control up to 5 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Sensor Switch MSD EZ (S)
Occupancy/vacancy and daylight harvesting. For full functionality and programming options, select settings option 3. If a different settings option is selected, other settings may be unavailable. For full details, please see MSD EZ spec sheets on the Sensor Switch website. Must be paired with DIM driver selection. Manual control of dimming not available with MSD EZ sensor.

*Sensor can control up to 30 drivers. Please refer to driver quantity chart on page 7. Multiple sensors may be required for longer lengths.

Lutron Vive DFCSJ (V)
The DFCSJ-OEM-OCC provides the capabilities of daylight harvesting and occupancy/vacancy sensing. When integrated with the DFC-OEM-DBI (Fixture Contril Digital Link Interface), the sensor is wirelessly compatible with the DE1 Lutron EcoSystem driver. Commissioning bt certified Lutron technician.

*Vive DFCSJ sensor can control up to a maximum of five (5) drivers per sensor. Please refer to driver chart on page 7. Multiple sensors may be required for longer lengths.

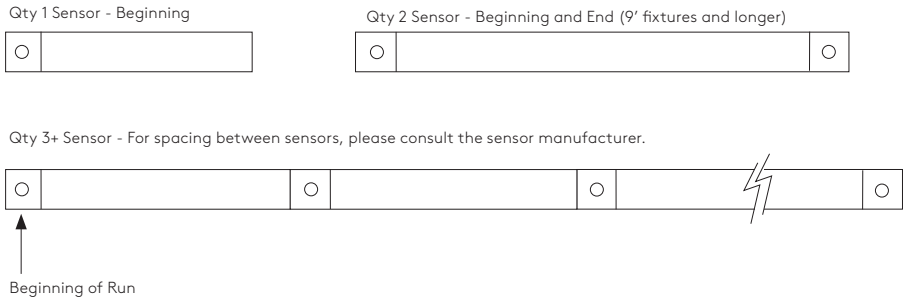
	Occupancy	Vacancy	Daylight Harvesting	Driver Compatibility
Enlighted SU-5E-IL (E)	√	√	√	DIM
Sensor Switch MSD EZ (S)	√	√	√	DIM
Lutron Vive DFCSJ (V)	√	√	√	DE1

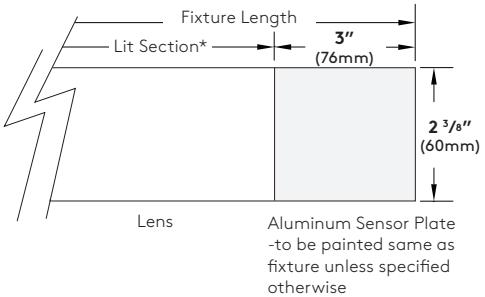
Please contact controls manufacturer for details prior to specifying.

Factory Presets - Sensors come from the sensor manufacturer with factory presets for each of the settings in above chart. Please see sensor manufacturers' spec sheets for details on presets and re-programming.

Commissioning - Commissioning of sensors and installation by others. Contact sensor manufacturer for details and costs associated with commissioning the system prior to specification of sensors.

Standard Sensor Placement - for other placement options, please consult factory. For functionality and limitations, please see sensor details above.





*Lit section will be the fixture length minus 3" for sensor plate.

Notes: 1. For spacing between sensors, please consult the sensor manufacturer.
2. Exact sensor placement and coverage will be defined by approved factory drawing.
3. Sections controlled by sensors may not be symmetrical - consult factory for layout.

Standard Direct shapes/configurations:

Listed below are the minimum lengths and details for standard shapes. These standard shapes can be combined with each other and/or the standard luminaire lengths, ensuring full even illumination. If you have any questions, please consult the factory.

The minimum standard lengths for "L" shapes:
- L9 or V9 open shapes is 4' x 4' nominal (example: leg, 90, leg)
- L9 or V9 closed shapes is 6' x 6' nominal (example: 90, leg, 90)
(Exception is that the L9 and V9's can be joined directly to provide a 4' x 4' nominal shape)

*For sensors in configurations, please consult factory.

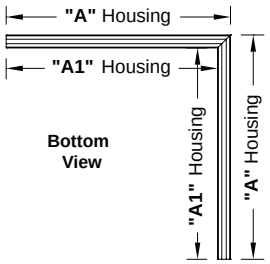
For patterns and configurations that are to include a wall mounted option, please consult the factory to identify location, on which side of housing and spacing of brackets required.

The minimum standard lengths for "T" and "X" shapes:
- T9 = 4' nominal on the short leg and 8' nominal on the long side
- X9 = 8' nominal for either direction

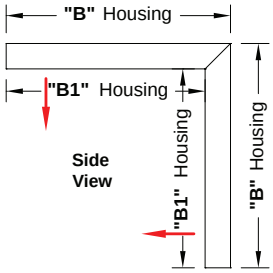
Project Specific Direct shapes/configurations:

Selux is capable of supplying a wide range of project solutions including different shapes, angles, and sizes to meet the project requirements. Due to the complex nature of these project specific layout(s) we ask that you please consult the factory with the project requirements for review.

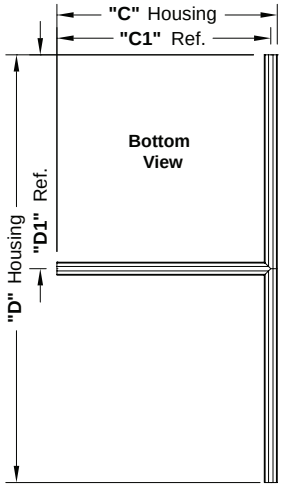
L9 - Lit Horizontal corner



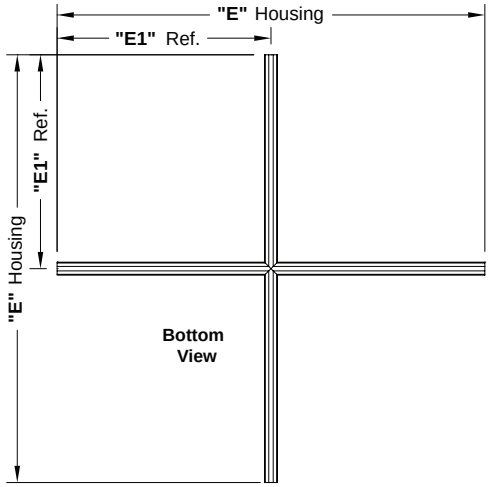
V9 - Lit Inside corner



T9 - Lit "T" section



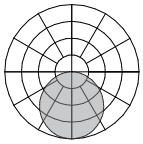
X9 - Lit "X" section



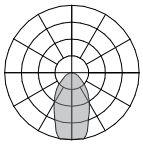
Direct Lit Corner and Section - Dimensions								
	L9		V9		T9		X9	
	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM	Feet/Inch	MM
"A" Housing (Outside)	2' - 1¼"	642						
"A1" Housing (Inside)	1' - 10¹⁵⁄₁₆"	582						
"B" Housing (Outside)			2' - 3¹⁄₁₆"	688				
"B1" Housing (Inside)			1' - 11½"	597				
"C" Housing					2' - 1¼"	642		
* "C1" Ref.					2' - ⅛"	612		
"D" Housing					4' - ³⁄₁₆"	1224		
* "D1" Ref.					2' - ⅛"	612		
"E" Housing							4' - ³⁄₁₆"	1224
* "E1" Ref.							2' - ⅛"	612

*Dimension(s) rounded to the nearest 1⁄16" with a ± 1⁄16" (1mm) tolerance.

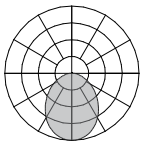
Photometry



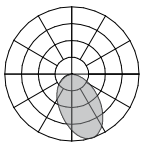
LW - LED Optimized White Lens				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2804	701	8.9	79



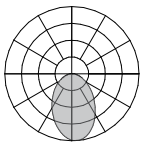
MI - Clear Lens with Microprism Inlay				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3251	813	8.9	92



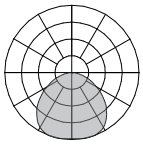
NB - LMO Symmetric				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3002	751	8.9	85



A2 - LMO Asymmetric 20° Wall Washer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3032	758	8.9	86



A5 - LMO Asymmetric 5° Wall Grazer				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	2807	702	8.9	79



BW - LMO Batwing				
Light Engine	Lumens per 4 foot	Lumens per foot	Input watts per foot	lm/W
1C35	3926	982	8.9	111

M60 Direct	
CCT Multiplier	
4000K	1.05
3500K	1.00
3000K	0.96
2700K	0.92
CRI Multiplier	
90+ CRI	1.00
80+ CRI	1.19
Lens Multiplier	
LW	1.00
MI	1.02
NB	1.22
A2	1.26
A5	1.26
BW	1.00

CCT and CRI multipliers apply to the photometry, IES files, and per foot values listed on page 1 (light engine).

Lens multipliers supplied for per foot values listed on page 1 (light engine).

LITECONTROL
making light work™

DATE: | LOCATION:

TYPE: LT- 08 SERIES | PROJECT: Compton College - VAPA

CATALOG #:

2L-W-D

MOD™ 2 LED WALL DIRECT

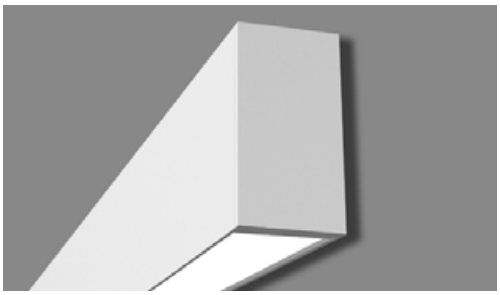
FEATURES

- Variable Intensity technology provides a range of specifiable outputs and resulting fixture wattages
- 2 SDCM color consistency
- End cap design eliminates visible diffuser seams/gaps

DLC QPL LISTED

BUY AMERICAN SOLUTIONS
See Certification Specifications

MODx



CONTROLS

NX DISTRIBUTED™ INTELLIGENCE

SpectraSync™ Color Tuning Technology

RELATED PRODUCTS

3L-W-D 4L-W-D 6L-W-D

SERVICE PROGRAMS

QS

PHOTOMETRY
DIMENSIONAL DRAWINGS
2L-W-D QUICK-SHIP

SPECIFICATIONS

CONSTRUCTION

- Housing constructed from extruded aluminum
- End caps constructed from die cast aluminum with magnetic interface
- End caps overlap diffuser at each fixture end to elimate gaps and LED visibility

OPTICAL PERFORMANCE

- 2 SDCM color consistency, 80 or 90 CRI
- SOF: Soft diffuse acrylic lens
- REG: ½" regressed softglo lens with painted steel inserts. Output multiplier (.77)
- BWO: White blade baffle with softglo lens overlay. Output multiplier (.70)
- ASYM: Asymmetric Highly transmissive diffuse acrylic lens with linear prisms
- DRP: ½" protruding soft diffuse "drop" lens

INSTALLATION

- Illuminated corners available in 90°, 120°, 135°. One piece construction, ready to install, with diffusers that match adjoining fixtures. Corner system connectors must be used to form patterns. The length of each outside or inside illuminated corner is 12"
- Fixture weight: 3lbs/ft

ELECTRICAL

- Variable Intensity (VI) technology allows precise specification of fixture output/ wattage. Fixture will be programmed and labeled to specification. Indirect and direct hemispheres can be independently specified
- LED boards and drivers can be accessed and removed from fixture, while installed
- Entire LED module can be removed and replaced
- 1C (1 Circuit) Fixture wired for a single circuit
- Emergency Battery: 10W battery powered driver. Provides a minimum of 90 minutes of emergency lighting. Inverter-Compatible. Provided by others. Available in 4'+' fixtures. Test switch located on side of housing

CONTROLS

- Sensors install between diffusers
- NX Distributed Intelligence™: Supports indoor and outdoor applications, wired, wireless and hybrid networked NX lighting control deployments and enabled emerging applications, such as Hubbell Lighting's SpectraSync™ Color Tuning Technology
- SpectraSync™ Color Tuning Technology: Control your space based on the needs of the application, specific activities throughout the day and preferences of the occupants

CERTIFICATIONS

- DLC® (DesignLights Consortium) Qualified - see www.designlights.org
- CSA listed for damp location
- IBEW
- AF of L
- UL924
- This product qualifies as a “designated country construction material” per FAR 52.225-11 Buy American-Construction. Materials under Trade Agreements effective 8/14/2020. See Buy American Solutions. Contact factory for configurations including SpectraSync, NX, or sensors.

WARRANTY

- LED boards - 5 years
- LED drivers (standard) - 5 years
- LED drivers (Lutron) - 3 years
- See www.litecontrol.com for details

KEY DATA	
Lumen Range Per Foot	D: 300–1000
Wattage Range Per Foot	2.9–12.1
Efficacy Range (LPW)	91–102
Rated Life (Hours)	L70: >61,000 L90: >61,000

HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

LITECONTROL
making light work™

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

= Service Program

Click icon for a list of Quick-Ship options

2L-W-D

MOD™ 2 LED WALL DIRECT

ORDERING GUIDE

Example: 2L-W-D-8-08-SOF-C1-27K-D030-D01-1C-UNV

CATALOG #

2L –

Series		Mounting		Fixture Distribution		Row Length (In Feet)		Max Length in Row		Direct Optical Distribution		Finish/Color [4]	
2L	MOD	W	Wall	D	Direct	__'	Enter in foot increments	02	2', 609 mm	SOF	Soft Diffuse Lens, Lambertian	C1	Matte White (Default)
				AD	Asymmetric Direct			03	3', 914 mm	REG	Regressed Diffuse Lens [1]	C2	Textured Matte White
								04	4', 1219 mm	BWO	Blade Baffle with Overlay [1]	C3	Light Silver
								05	5', 1524 mm	ASYM	Asymmetric Diffuse Lens [1, 2]	C4	Machined Aluminum
								06	6', 1829 mm	DRP	Drop Lens [1, 3]	C5	Carbon Black
								08	8', 2438 mm			C6	Textured Camera Black
												CC	Custom Color

Color Temperature		Direct Output/ft [6]		Driver		Circuiting		Voltage	
27K	2700K [3]	D030	300 (min)	D01	1% Dimming, 0-10V	1C	1 Circuit	UNV	Universal Voltage (120V through 277V)
30K	3000K		*to*	D00	1% Dim-to-Off, 0-10V			347	347 Volt [3, 8]
35K	3500K	D100	1000 (max)	D05	SpectraSync 5% Dimming, 0-10V [7]				
40K	4000K			DS1	1% Dimming w/ Soft Start, 0-10V				
50K	5000K [3]			DS0	1% Dim-to-Off w/ Soft Start, 0-10V				
27K9	2700K, 90 CRI [3]			LEC	Hi-lume 1% Ecosystem LED Driver				
30K9	3000K, 90 CRI			DALI	DALI [3]				
35K9	3500K, 90 CRI			DALIP	Powered by DALI (2.0) [3]				
40K9	4000K, 90 CRI			NDM	Non-Dimming				
50K9	5000K, 90 CRI [3]								
2230TD	2200K-3000K SpectraSync™ Dim-to-Warm [5]								
2750T	2700K-5000K SpectraSync™ Tunable White [5]								
2765T	2700K-6500K SpectraSync™ Tunable White [5]								

OPTIONAL

Nightlight		Emergency		Thru-wiring		Patterns [3, 11]	
NL	Nightlight Circuit Required. Enter quantity. 2NL = 2 nightlight circuits/row	EF	10W Emergency Battery Pack. Enter quantity. 2EF = 2 emergency batteries/row. [9]	W1	No Thru Wire	C90L	Illuminated 90° Corner
				W2	Provide Normal and Emergency/ Nightlight Thru Wiring [10]	C120L	Illuminated 120° Corner
				W3	Provide Normal Thru Wiring Only	C135L	Illuminated 135° Corner

Control Options [3]	
NX Standalone	
NXS	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount [12, 13, 14]
NX Networked – Wired	
NXE	NX, Dual SmartPorts [12, 13]
NXES	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount, Dual SmartPORTs [12, 13]
NX Networked – Wireless	
NXSW	NX Wireless, PIR BT Occupancy/Daylight Sensor [12, 13, 14]
NXWE	NX Wireless Wireless Enabled [12, 13]
NX Networked – Wired/Wireless	
NXSWD	NX Wireless, PIR BT Occupancy/Daylight Sensor, Dual SmartPORTs [12, 13, 14]
NXWD	NX Wireless, Dual Smart Ports [12, 13]
Sensors	
SD1	Daylight Sensor Required. Enter quantity. 2SD1 = 2 daylight sensors/row
SO1	Occupancy Sensor Required. Enter quantity. 2SO1 = 2 occupancy sensors/row

Notes:

1 Not Available with Patterns.
2 Must be ordered with AD.
3 Additional lead time may be applicable. Contact factory.
4 Visit www.litecontrol.com/finishes for details.
5 Must be ordered with D05 Driver option; excludes 2' lengths and patterns.
6 Specifiable in 50 lumen increments. Reference the Performance Data Table for full performance offering and exceptions.
7 Must be ordered with 2230TD, 2750T or 2765T Option
8 Excludes Emergency Battery Pack 'EF' Option. Excludes DALI, DALIP and Lutron (LEC) Dimming Drivers
9 EF - 10W battery powered driver. Provides a minimum of 90 minutes of emergency lighting. Inverter-Compatible. Provided by others.
10 Only applicable when specified with Emergency/Nightlight.
11 Contact Factory for pattern configurations. Approval drawings required.

NX In-Fixture Control Options:

12 Not available for row mounting. Only available with 0-10V Driver options. Contact factory for Length restrictions.
13 Refer to NX Integrated Controls Reference Table for Functionality of Options.
14 NX Sensors with Bluetooth, BLE, provides remote commission only.

HUBBELL Lighting

LITECONTROL
making light work™

2L-W-D

MOD™ 2 LED WALL DIRECT

CONTROLS

NX DISTRIBUTED™ INTELLIGENCE

NX Distributed Intelligence™ Lighting Controls:

Supports both indoor and outdoor applications in a variety of deployment options- wired, wireless, hybrid.
Integrates with and enables a wide array of luminaires including those with SpectraSync Color Tuning Technology.

NX INTEGRATED CONTROLS REFERENCE								
NX Option	Sensor	Networkable	Scheduling	Occupancy	Daylight Harvesting	0–10V Dimming	On/off Control	Bluetooth® App Programming
NX Standalone								
NXS	NXSMP-SMI	No	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wired								
NXE	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R [1]
NXES	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wireless								
NXSW	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NXWE [2]	N/A	Yes	Yes	No	No	Yes	Yes	No [3]
NX Networked – Wired/Wireless								
NXSWD	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NXWD	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R [1,3]

1 NXBTC/R needs to be plugged into an available NX SmartPort™ on the fixture network
2 Programming via App requires factory assistance
3 To program NXWE option, need to consult factory. If connected to an area controller, programming can be done from that

SpectraSync™ Color Tuning Technology:

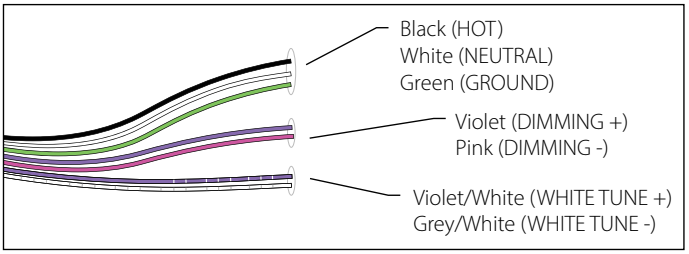
Control your space based on the needs of the application, specific activities throughout the day and preferences of the occupants with distinct SpectraSync™ Color Tuning Technologies.

SpectraSync™ Color Tuning Technology

SPECTRASYNC COLOR TUNING TECHNOLOGY		
Mode	Kelvin Range	Description
Dim to Warm	2200K-3000K	Mimics the familiar warming effect that occurs with traditional incandescent sources as they are dimmed
Tunable White	2700K-5000K 2700K-6500K	Offers users the ability to tailor CCT to their personal preference, enhancing task visibility, material and colors or the aesthetics of the space
Scheduled White	2700K-5000K 2700K-6500K	Mimics the rhythm of natural light or follows an alternative user-defined schedule throughout the day, enhancing an occupant's mood and well-being

SpectraSync Tunable White

Available in two options: 2750T (2700K–5000K) or 2765T (2700K–6500K).
Requires two 0–10V controllers, one for intensity and one for CCT.
Minimum 5% dimming.

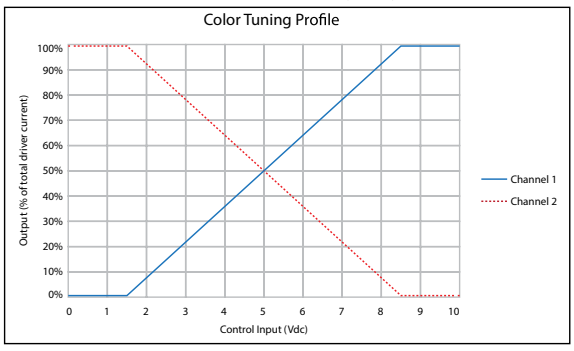


SpectraSync Tunable White luminaires are provided with two 0–10V circuits. The violet and pink circuit is for wiring to any qualified 0–10V controller for dimming. The violet/white and grey/white circuit is for wiring to any qualified 0–10V controller for Tunable White CCT control.

Controller Manufacturer Data

SpectraSync Tunable White was designed to be used with sinking style dimmers (provided by others) and is compatible with:

- Hubbell Control Solutions (HCS): NX Distributed Intelligence™ Room Controllers (NXRC) and In-fixture Controllers (NXFM)
- Lutron: DVTV, DVSTV, and NFTV dimmers
- Wattstopper: ADF120277 and CD4BL (Titan) dimmers



NX Design & Application Guide
NX Brochure
SpectraSync
NX Solutions Guide

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2L-W-D

MOD™ 2 LED WALL DIRECT

PERFORMANCE DATA TABLE

The table below shows the delivered lumens for the various lumen outputs. Use this chart in connection with the output multiplier capability to deliver any output required.

Nomenclature	Lumens/Ft	W/Ft	Efficacy
Downlight			
D030 (min)	300	2.9	102
D050	500	5.2	96
D085	850	8.6	99
D100	1000	12.1	91

(wattage may vary up to 5% from published)

Output Restrictions

Driver options listed below are not available for the output and length as shown.

Restrictions - Direct		Output LPA						
		300	350	400	450	500	950	1000
Length (feet)	2	LEC, DALI, 347V	LEC, DALI, 347V	DALI, 347V	DALI, 347V	DALI, 347V	LEC	LEC
	3	DALI, 347V	DALI, 347V				LEC	LEC
	4						LEC	LEC
	5						LEC	LEC
	6						LEC	LEC
	8						LEC	LEC

Output Multiplier Table

Photometrics for the 4L are published here at a nominal 3500K temperature. This table may be used to approximate the lumen values at different Kelvin temperatures. Power consumption would stay the same.

Option	2700K	3000K	3500K	4000K	5000K	2700K 90 CRI	3000K 90 CRI	3500K 90 CRI	4000K 90 CRI	5000K 90 CRI
SOF	0.95	0.98	1.00	1.03	1.05	0.83	0.85	0.88	0.90	0.93
REG	0.73	0.75	0.77	0.79	0.81	0.64	0.65	0.68	0.69	0.72
BWO	0.67	0.69	0.70	0.72	0.76	0.63	0.53	0.47	0.42	0.39
ASYM	0.95	0.98	1.00	1.03	1.05	0.83	0.85	0.88	0.90	0.93
BAT	0.95	0.98	1.00	1.03	1.05	0.83	0.85	0.88	0.90	0.93
DRP	0.95	0.98	1.00	1.03	1.05	0.83	0.85	0.88	0.90	0.93
LPAD	0.86	0.88	0.90	0.93	0.95	0.75	0.77	0.79	0.81	0.84

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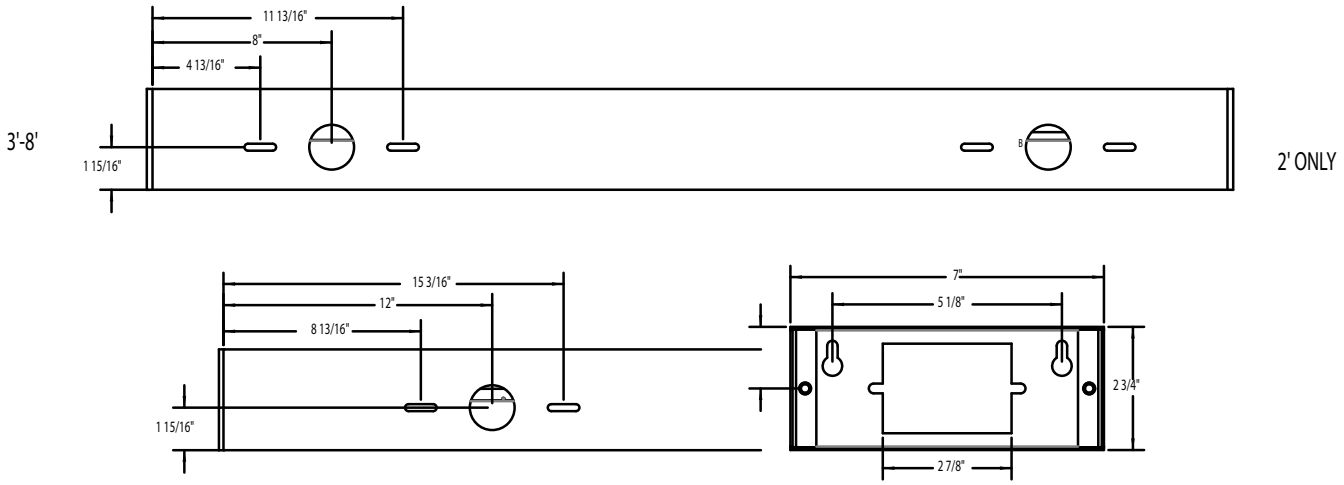
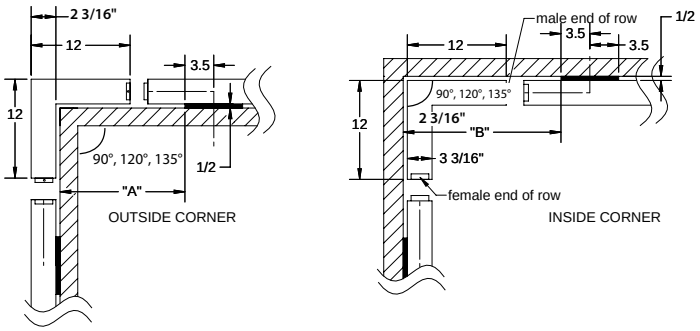
MOD™ 2 LED WALL DIRECT

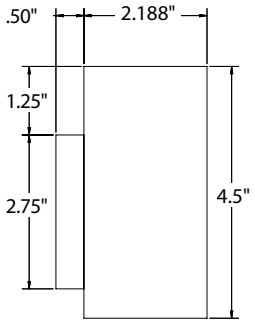
DIMENSIONS



INDIVIDUAL MOUNTING



PATTERNS



END CAP VIEW

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MOD™ 2 LED WALL DIRECT

PHOTOMETRY

2L-W-D-04-SOF-X-CX-35K-D100

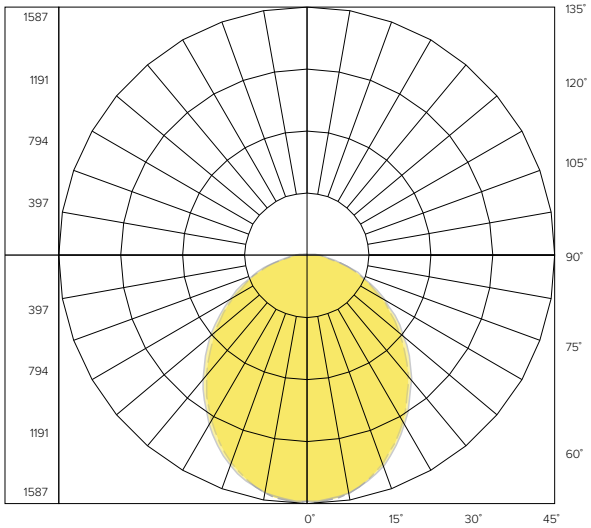
LUMINAIRE DATA

Description	**2L Wall, Soft Diffuse Lens, 3500K**
Delivered Lumens	**3999**
Watts	**42**
Efficacy	**95**
Mounting	**Wall**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–40	1905.97	47.7
0–60	3229.26	80.7
0–90	3999.61	100.0
0–180	3999.61	100.0

POLAR GRAPH



2L-W-AD-4-ASYM-X-CX-35K-D050

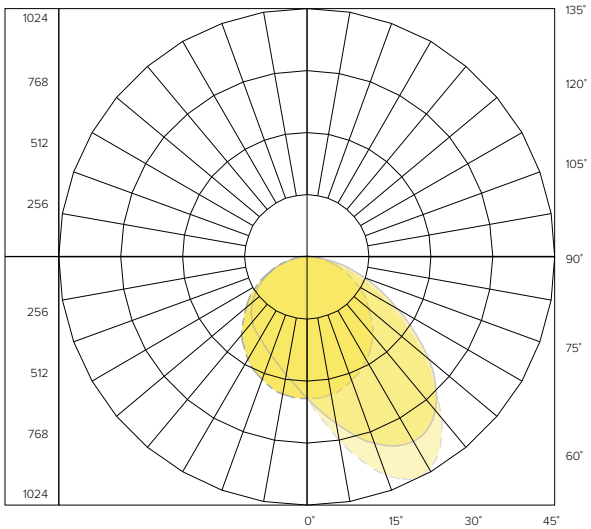
LUMINAIRE DATA

Description	**2L Wall, Soft Diffuse Lens, 3500K**
Delivered Lumens	**1999**
Watts	**20**
Efficacy	**82**
Mounting	**Wall**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–40	896.16	44.8
0–60	1613.68	80.7
0–90	1999.5	100.0
0–180	1999.96	100.0

POLAR GRAPH



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PHOTOMETRY CONTINUED

2L-X-D-04-DRP-CX-35K-D050

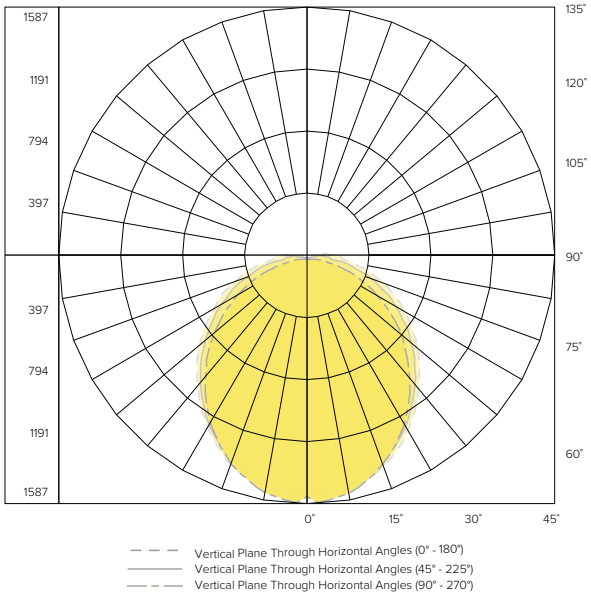
LUMINAIRE DATA

Description	**2L Wall, Drop Lens, 3500K**
Delivered Lumens	**3999**
Watts	**21**
Efficacy	**95**
Mounting	**Wall**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–40	801.88	40.1
0–60	1408.37	70.40
0–90	1904.98	95.20
0–180	1999.98	100.0

POLAR GRAPH



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Received
By PCM3 at 12:54 pm, April 27, 2023

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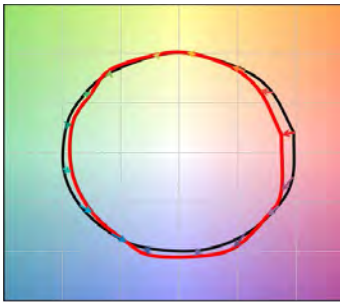
MOD™ 2 LED WALL DIRECT

TM-30 DATA

COLOR VECTOR GRAPHIC



*Graphics shown are at 35K

Reference Illuminant — Test Source

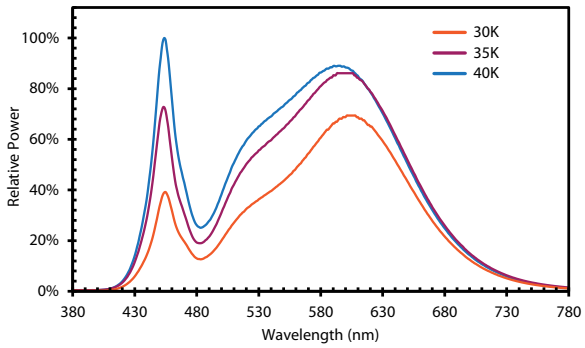
COLOR DISTORTION GRAPHIC

TEST RESULTS - 3500K	
Value	80+ CRI
CCT (K)	3494
CIE R_a	83
D_{UV}	-0.0004
R_f	82
R_g	96
x	0.4052
y	0.3898

COLOR CHARACTERISTICS:

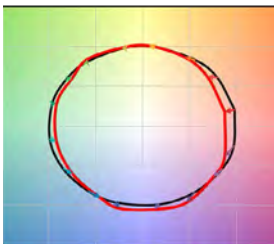
Value	Ordering Code		
	30K	35K	40K
Rf	83	82	82
Rg	96	96	96
CCT (K)	3009	3494	3975
Duv	-0.0009	-0.0004	-0.0003
x	0.435	0.4052	0.3814
y	0.4012	0.3898	0.3768
CIE Ra	83	83	84

SPECTRAL DISTRIBUTION:

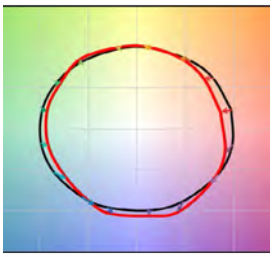


COLOR VECTOR GRAPHIC:

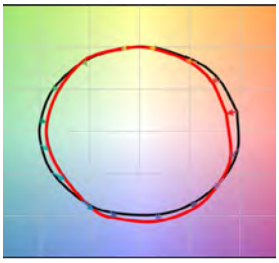
30K



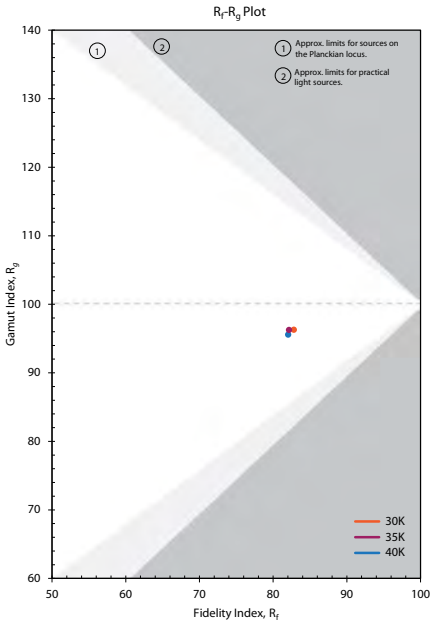
35K



40K



COLOR GAMUT/FIDELITY PLOT:



CRI: 80 MINIMUM

CCT	CRI	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
30K	83	82	91	97	81	82	89	84	62	13	79	79	69	84	99
35K	83	81	89	95	81	81	85	86	65	13	73	79	62	83	97
40K	84	82	90	94	82	82	85	87	68	17	74	80	60	84	97

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MOD™ 2 LED WALL DIRECT

ADDITIONAL INFORMATION

Driver

D01	100%- 1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
D00	Dim-to-Off 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
D05	100%-5% dimming range, Fixture will be wired for low voltage 0-10V dimming control. Only applicable if either 2230TD, 2750T or 2765T is selected.
DS1	Soft-Start 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
DS0	Soft-Start Dim-to-Off 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
LEC	Hi-Lume 1% EcoSystem LED Driver with Soft-On, Fade-to-Black dimming technology.
DALI	DALI compatible.
DALIP	Self-Powered DALI bus (e.g. DEXAL)
NDM	Non-dimming. Fixture will be wired for fixed light output.

Rated Life

Tested in accordance to LM79-2008 & derived from EPA TM-21 calculator
L70: 280,000 (calculated per TM-21 extrapolated curve)
L70: >61,000 (reported per TM-21/LM80 6x's limitation)
L90: 72,000 (calculated per TM-21 extrapolated curve)
L90: >61,000 (reported per TM-21/LM80 6x's limitation)

Rated Life (Driver)

Standard = 100,000 hours
Lutron = 50,000 hours

HUBBELL Lighting

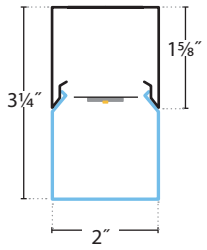
BoltPro | Linear, Surface & Wall

PRUDENTIAL LTG.
PRULITE.COM 213.746.0360

LT- 09

Type:

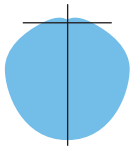
Job: Compton College - VAPA



Snap's sleeker, more sophisticated sibling now with much higher lumen levels (and efficiencies). Improved aesthetic with more LEDs close together for smooth, soft side viewing of lens. Available in any row length (1⁄16″ increments) and a multitude of fully illuminated corners.

Want to keep the older Bolt lumen levels?
Specify: PROG500 = 500 lumens/ft
PROG7W = 7 watts/ft

CLICK HERE FOR OLDER BOLT SPECS



BOLT-PRO-LED35-LO-SAL

1962	Delivered Lumens
15	Watts
131	lm/w

NEW HIGHER LUMEN LEVELS

UP TO 131 LPW

	LO	MO	SO	HO
lm/ft	490	825	1140	1425
w/ft	3.75	6.5	9.4	12.5

Lumen output may vary +/– 5%
Light Loss Factor (LLF) for CCTs other than 3500K:
4000K +2%, 3000K -5%, 2700K -20%
90 CRI -15% (3K, 3500K, 4K & 5K)
See LED Details PDF for more info

Declare. JA8 TITLE 24 LED WARRANTY 5 YEAR LED Details Made in the USA

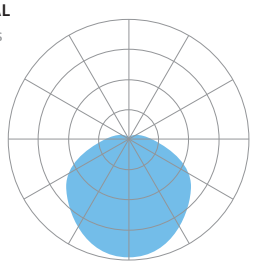
SERIES	LED COLOR	OUTPUT	NOMINAL LENGTH	SHIELDING	COLOR/ FINISH	VOLTAGE	MOUNTING	CEILING SYSTEMS	DRIVERS	OPTIONS, SENSORS & CORNERS
BOLT-PRO				SAL						
	LED27 2700K (90CRI) LED3 3000K LED35 3500K LED4 4000K LED3-90 90CRI LED35-90 90CRI LED4-90 90CRI LED5-90 90CRI	LO Low MO Medium SO Standard HO High PROG Programmable Light Output (Specify desired lm/ft or w/ft)	2′ 3′ 4′ 5′ 6′ 7′ 8′ R___ (Row length to 1⁄16″) SRL Symmetric Row Length (See page 5.) Row lengths are typically made up of 8′ and 4′ fixtures, (eg. 12′ row is (1) 8′ and (1) 4′), unless SRL Symmetric Row Lengths are specified **NOTE:** Individual fixtures are NOT intended for row mounting For Patterns, Specifiers may write in 'Pattern' and include a drawing with corners and dimensions	SAL Satin Acrylic Lens	TMW Textured Matte White YGW Gloss White (Standard) Y__ Premium Color CC Custom Color **NOTE:** All canopies are painted the same color as the fixture. Consult factory to specify	UNV (120-277) 347 (Emergency battery requires a Step Down transformer)	SUR Surface or Wall Mount CA48″, 96″ & 144″ Aircraft Cable (Adjustable)	X1 T-Bar 15⁄16″ or 9⁄16″ (Standard) Consult factory for 9⁄16″ Tegular X2 Dimensional T-Bar Armstrong Interlude® X3 Hard Ceiling X6 Slot Grid or Interlude	ND Non-Dimming DM01 0-10v, 1% Dimming (Standard) LDE1 Lutron Hi-lume 1% EcoSystem LED (Soft fade on, fade-to-black dimming) ECO 1% 0-10v, EldoLED (Logarithmic dimming std) ECDA 1% DALI, EldoLED (Logarithmic dimming std) SOLO 0.1% 0-10v, EldoLED (Dim-to-dark, Logarithmic dimming std) SODA 0.1% DALI, EldoLED (Dim-to-dark, Logarithmic dimming std	EMHE CA T20 Emergency Battery (1250 Delivered lumens; CA Title 20 compliant; 4′ or longer) ETS-DR Iota ETS-DR Emergency Transfer Switch EBCP1G/2G Single/ Dual Gang (Electrical Box Cover Plate/Mud Ring) JA8 90 CRI, ECO 30W Driver Only (Consult factory for pricing) **SENSORS:** 205-ON/OFF WattStopper PIR Occupancy (No power to fixture) 205-DM WattStopper PIR Occupancy (Sets to min. dimming level) ENL Enlighted SU-5E-IOT LUX Phillips DL LVOC Lutron Vive (Occ & RF) LVRF Lutron Vive (RF Only) NXSMP Hubbell (Occ) **CORNERS:** C2 Lit 2-Way C3T Lit 3-Way 90°: T C3Y 120° Lit 3-Way: Y C4 Lit 4-Way 90° Cross C2X Lit 2-Way, (Any angle 45° to 179°, 1° increments) C3T-X Lit 3-Way: T (45° to 135°) C3Y-X Lit 3-Way: Y (45° to 135°) C4X Lit 4-Way (45° to 135°)

BoltPro | Linear, Surface & Wall

PHOTOMETRICS

Medium Output:
BOLT-PRO-LED35-LO-SAL

1962 Delivered Lumens
15 Watts
131 lm/w
3500 CCT
Test
#104160086LAX-016



Zonal Lumen Summary:
0-90 (Down) = 86.5%
90-180 (Up) = 13.5%

Vertical Angle	0°	22.5°	45°	67.5°	90°
0°	525	525	525	525	525
5°	523	523	522	526	527
15°	492	497	502	509	512
25°	434	447	458	470	474
35°	358	379	402	424	434
45°	274	305	345	384	402
55°	193	232	289	343	366
65°	120	165	231	290	314
75°	59	106	172	224	243
85°	0	58	117	157	169
90°	0	46	98	131	140
95°	0	42	87	113	120
105°	0	34	69	87	90
115°	0	26	56	69	72
125°	0	20	44	57	59
135°	0	15	32	43	47
145°	0	10	23	0	0
155°	0	0	15	21	23
165°	0	0	11	16	16
170°	0	0	0	11	12

LUMEN MAINTENANCE

L70 — 200,000+ Hours
L90 — 100,000+ Hours (LO, MO & SO)
L90 — 60,000+ Hours (HO)

LED SYSTEM LED modules and drivers are field replaceable.

PROG (OPTIONAL) Programmable light output. Specify desired lumens or watts per linear foot. Min: 3.75 w/ft, Max 12.5 w/ft.

BINNING Standard binning (all Prudential LED boards) includes testing at the chip level and board integration to provide consistent color temperature within a 3-step MacAdam ellipse, with +/- 5% lumen output range and +/- .004 Duv.

LABELS CSA and ETL damp labeled and I.B.E.W. manufactured.

ELECTRICAL Must specify LED dimming controls. LED fixtures have constant current driver(s) with less than 20% THD when loaded to a minimum of 60%. Drivers sink a maximum of 6mA per driver. DM01 LED drivers are 0-10V dimmable and are compatible with most 0-10V wall slide dimmers and direct 0-10V analog signal dimmers. Max driver size 1.65˝ w x 1.25˝ h.

32v Forward Voltage (+/– 1 volt based on drive current)

Drive Currents: **LO:** 100mA, **MO:** 100mA, **SO:** 250mA, **HO:** 325mA

CONSTRUCTION

Housing — Extruded aluminum, 25% PC recycled, 100% recyclable

End Caps — Cast aluminum, >25% PC recycled, 100% recyclable

Lens — Single-piece (up to 8´ lengths) extruded acrylic, 100% recyclable

Weight — 2 lbs/ft

MOUNTING Surface mounted to walls or ceilings or suspended by cable.

WARRANTY Single-source, 5 year limited warranty covers standard components and construction.

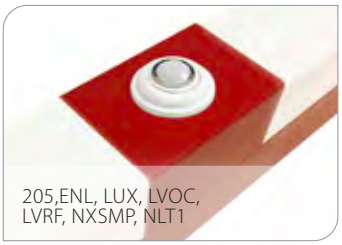
PRUDENTIAL LTG.
PRULITE.COM 213.746.0360

YSW – Seashell White (Matte)
YCH – Champagne (Metallic)
YSL – Silver (Metallic)
YPE – Pewter (Matte)
YRG – Rain Grey (Gloss)
YSTM – Storm Grey (Matte)
YBK – Black (Matte)
YBB – Black (Semi Gloss)
YSKM – Sky (Matte)
YMB – Military Blue (Matte)
YIB – Interstate Blue (Matte)
YSAM – Sapphire (Matte)
YFGM – Forest Green (Matte)
YBR – Bronze (Matte)
YBY – Boysenberry (Matte)
YSRM – Sunset Red (Matte)
YOR – Orange (Matte)
YDAM – Daffodil (Matte)

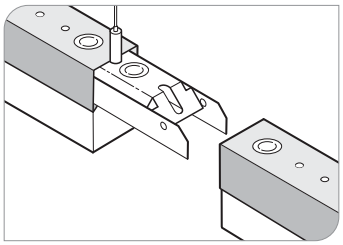
Choose from one of our Premium Colors with no set-up fee.

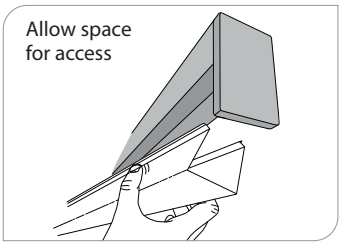
For paint chip samples, please email:
info@prulite.com

SENSOR BOX



ADJOINING DETAILS



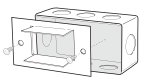


NOTES:

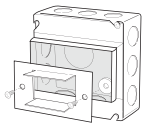
— Sensor plate will match fixture color.
— 3′ or longer fixtures.
— Consult factory for other sensors.

EBCP ELECTRICAL BOX COVER (OPTIONAL)

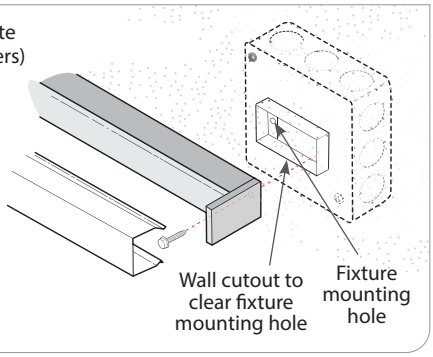
⅞″ Dia. K.O. will accommodate
2″x 4″ or 4″x 4″ J-Box (by others)



1G: SINGLE GANG

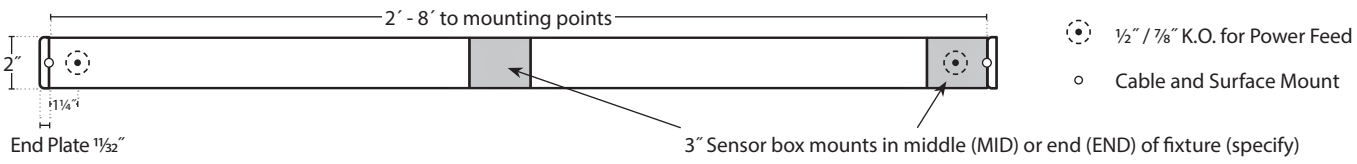


2G: DUAL GANG

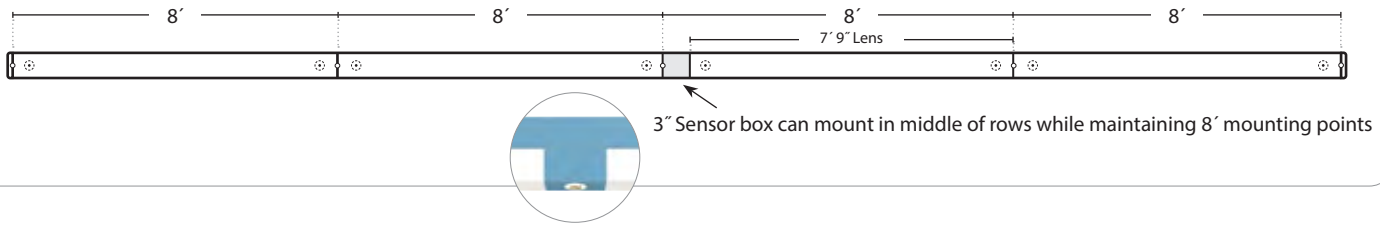


MOUNTING LOCATIONS

INDIVIDUAL FIXTURE:



CABLE OR SURFACE MOUNTING WITH SENSOR BOX:



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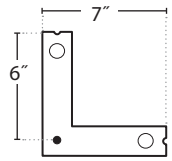
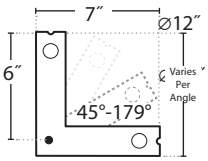
CORNERS

C2

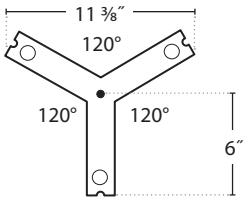


C2-X

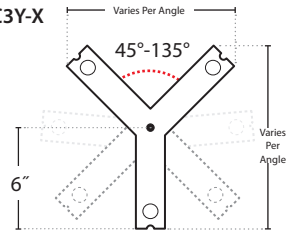


Minimum 45° angle

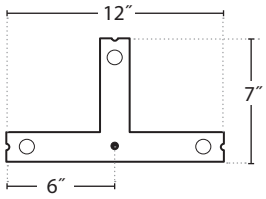
C3Y



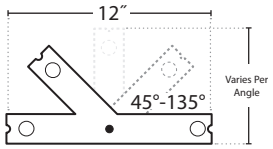
C3Y-X



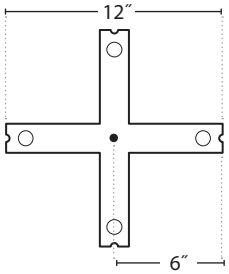
C3T



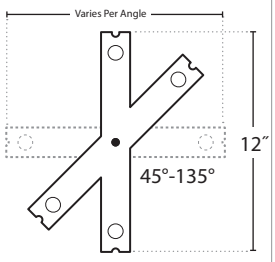
C3T-X



C4



C4-X

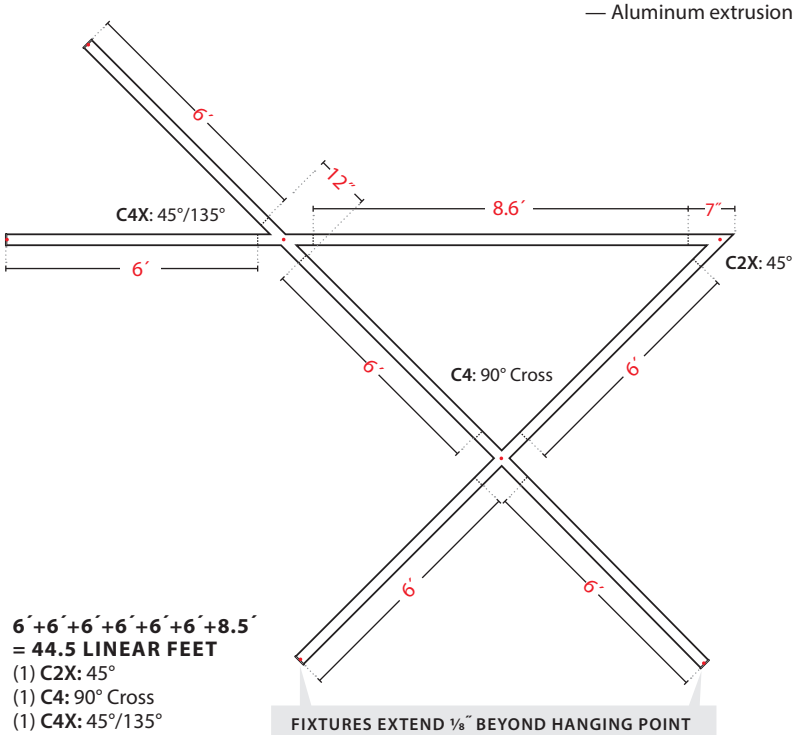


• Mounting Hole ○ ⅞″ K.O. Hole

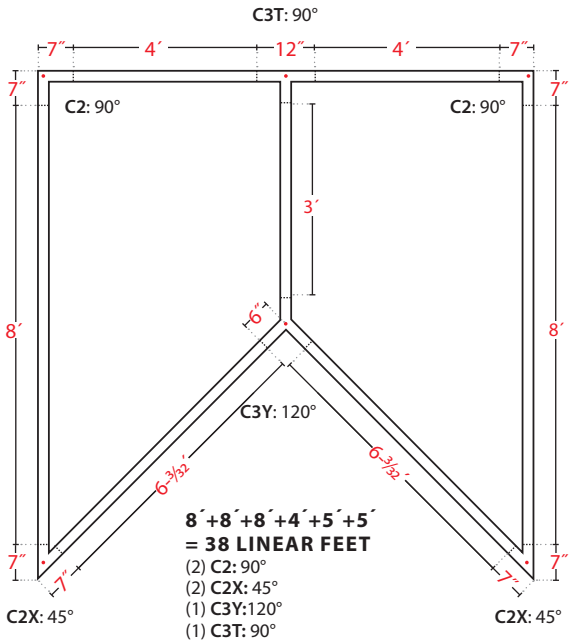
SPECIFYING PATTERNS:

A configuration drawing is required (examples below), consult factory for assistance.

NOTE:
— Lens seams only at mitered corners or lengths above 8´
— Aluminum extrusion



6´+6´+6´+6´+6´+6´+8.5´
= 44.5 LINEAR FEET
(1) **C2X:** 45°
(1) **C4:** 90° Cross
(1) **C4X:** 45°/135°



8´+8´+8´+4´+5´+5´
= 38 LINEAR FEET
(2) **C2:** 90°
(2) **C2X:** 45°
(1) **C3Y:**120°
(1) **C3T:** 90°

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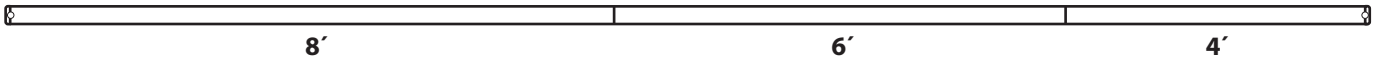
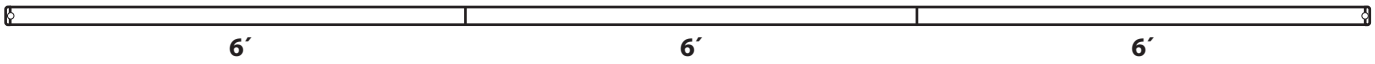
18´ TYPICAL:



18´ SYMMETRIC ROW LENGTH (SRL):



ROW LENGTH	FIXTURE BREAKDOWN	SYMMETRIC ROW LENGTH (SRL)
9´	(1) 6´ + (1) 3´	(3) 3´
10´	(1) 6´ + (1) 4´	5´ + 5´
11´	(1) 8´ + (1) 3´	4´ + 3´ + 4´
12´	(1) 8´ + (1) 4´	(2) 6´
13´	(1) 8´ + (1) 5´	4´ + 5´ + 4´
14´	(1) 8´ + (1) 6´	(2) 7´
15´	(1) 8´ + (1) 7´	(3) 5´
16´	(2) 8´	—
17´	(1) 8´ + (1) 6´ + (1) 3´	6´ + 5´ + 6´
18´	(1) 8´ + (1) 6´ + (1) 4´	(3) 6´
19´	(2) 8´ + (1) 3´	6´ + 7´ + 6´
20´	(2) 8´ + (1) 4´	8´ + 4´ + 8´
21´	(2) 8´ + (1) 5´	(3) 7´
22´	(2) 8´ + (1) 6´	8´ + 6´ + 8´
23´	(2) 8´ + (1) 7´	8´ + 7´ + 8´
24´	(3) 8´	—
25´	(2) 8´ + (1) 6´ + (1) 3´	(5) 5´
26´	(2) 8´ + (1) 6´ + (1) 4´	7´ + 6´ + 6´ + 7´
27´	(3) 8´ + (1) 3´	5´ + 5´ + 7´ + 5´ + 5´
28´	(3) 8´ + (1) 4´	(4) 7´
29´	(3) 8´+ (1) 5´	6´ + 6´ + 5´ + 6´ + 6´

ROW LENGTH	FIXTURE BREAKDOWN	SYMMETRIC ROW LENGTH (SRL)
30´	(3) 8´ + (1) 6´	(5) 6´
31´	(3) 8´ + (1) 7´	6´ + 6´ + 7´ + 6´ + 6´
32´	(4) 8´	—
33´	(3) 8´ + (1) 6´ + (1) 3´	7´ + 7´ + 5´ + 7´ + 7´
34´	(3) 8´ + (1) 6´ + (1) 4´	7´ + 7´ + 6´ + 7´ + 7´
35´	(4) 8´ + (1) 3´	(5) 7´
36´	(4) 8´ + (1) 4´	(6) 6´
37´	(4) 8´ + (1) 5´	8´ + 8´ + 5´ + 8´ + 8´
38´	(4) 8´ + (1) 6´	8´ + 8´ + 6´ + 8´ + 8´
39´	(4) 8´ + (1) 7´	8´ + 8´ + 7´ + 8´ + 8´
40´	(5) 8´	—
41´	(4) 8´ + (1) 6´ + (1) 3´	6´ + 6´ + 6´ + 5´ + 6´ + 6´ + 6´
42´	(4) 8´ + (1) 6´ + (1) 4´	(6) 7´
43´	(5) 8´ + (1) 3´	6´+ 6´ + 6´ + 7´ + 6´ + 6´ + 6´
44´	(5) 8´ + (1) 4´	6´ + 6´ + 6´ + 8´ + 6´ + 6´ + 6´
45´	(5) 8´ + (1) 5´	7´ + 7´ + 7´ + 3´ + 7´ + 7´ + 7´
46´	(5) 8´ + (1) 6´	7´ + 7´ + 7´ + 4´ + 7´ + 7´ + 7´
47´	(5) 8´ + (1) 7´	7´ + 7´ + 7´ + 5´ + 7´ + 7´ + 7´
48´	(6) 8´	—
49´	(5) 8´ + (1) 6´ + (1) 3´	(7) 7´
50´	(5) 8´ + (1) 6´	(10) 5´

NOTE: SRL will effect pricing – please consult factory.

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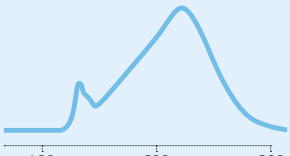
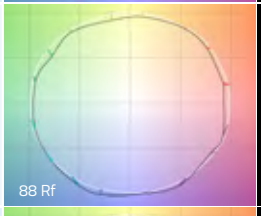
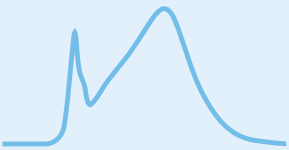
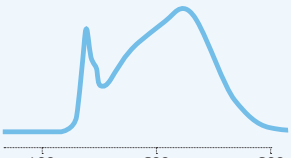
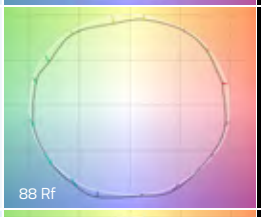
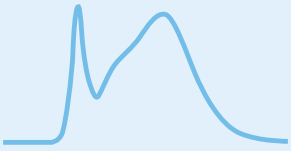
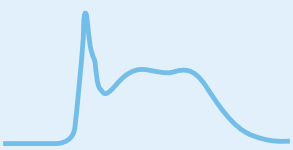
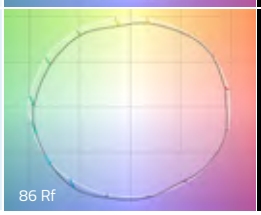
LM79 & TM30 DATA:

	MEASURED CCT	MEASURED LUMENS	CRI	R9	DuV	SPD	TM30 — COLOR VECTOR	TM30 — COLOR DISTORTION
LED27	2680	80%	93	58	0.001			
LED3	3042	95%	82	6	0.001			
LED3-90	3016	85%	93	61	0.000			
LED35	3482	100%	82	3	0.002			
LED35-90	3417	85%	93	67	0.000			
LED4	3952	102%	82	4	0.003			
LED4-90	3882	85%	92	67	0.003			
LED5-90	4889	85%	94	84	0.002			

LITECONTROL
making light work™

DATE: LOCATION:

TYPE: LT- 09A PROJECT: Compton College - VAPA

CATALOG #:

67L-S-D

NOTE LED SURFACE DIRECT

FEATURES

- Variable Intensity technology provides a range of specifiable outputs and resulting fixture wattages
- 2 SDCM color consistency
- Up to 127 LPW efficacy
- Output range from 550 to 2000 lumens/ft
- Removable Lens for ease of accessibility and installation

BUY AMERICAN SOLUTIONS
See Certification Specifications

RELATED PRODUCTS

67L-P-D 67L-W-D

SPECIFICATIONS

CONSTRUCTION

- Fixture housing: extruded aluminum
- End caps: die cast aluminum
- Lens: acrylic

OPTICAL PERFORMANCE

- 2 SDCM color consistency, 80 or 90 CRI

INSTALLATION

- Installs with anchor screws (by others) for mounting directly to surface with 2x4 junction box
- A 2x4 junction box cover ships separately
- Each row joining uses #8-32 machine screws/nuts for pulling the fixture flush at the end header location
- Lenses ship installed
- End caps must be installed on site

ELECTRICAL

- 1C (1 Circuit) fixture wired for a single circuit
- Lens, LED Boards and drivers can be accessed and removed from installed fixture
- LED Boards can be replaced as part of a module

CERTIFICATIONS

- DLC® (DesignLights Consortium) Qualified - see www.designlights.org
- CSA listed for damp location
- This product qualifies as a “designated country construction material” per FAR 52.225-11 Buy American-Construction. Materials under Trade Agreements effective 8/14/2020. See Buy American Act Solutions. Contact factory for configurations including SpectraSync, NX, or sensors.

WARRANTY

- LED boards - 5 years
- LED drivers (standard) - 5 years
- LED drivers (Lutron) - 3 years
- See www.litecontrol.com for details

KEY DATA	
Lumen Range Per Foot	550-2000
Wattage Range Per Foot	4.2-15.7
Efficacy Range (LPW)	118-134
Rated Life (Hours)	L70: >61,000 L90: >61,000

HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

LITECONTROL
making light work™

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

67L-S-D

NOTE LED SURFACE DIRECT

ORDERING GUIDE

Example: 67L-S-D-8-8-DM-C1-35K-D150-D01-1C-UNV-FA1

CATALOG # _____

67L – _____ – _____ – _____ – _____ – _____ – _____ – _____

Series		Mounting		Fixture Distribution		Row Length (In Feet)		Max Length In Row		Lens Type		Finish/Color [2]	
67L	Note	**S**	Surface	**D**	Direct	**__'**	Enter in foot increments [1]	**2**	2', 610mm	**DM**	Dome	**C1**	Matte White (Default)
								3	3', 914mm	**BL**	Bell	**C2**	Textured, Matte White
								4	4', 1219mm	**SQ**	Square	**C3**	Light Silver
								6	6', 1829mm			**C4**	Machined Aluminum
								8	8', 2438mm			**C5**	Carbon Black
												C6	Textured, Camera Black
												CC	Custom Color

_____ – _____ – _____ – _____ – _____ – _____

Color Temperature		Output/ft [4]		Driver		Circuiting		Voltage	
27K	2700K	**D055**	550 (min)	**D01**	1% Dimming, 0-10V	**1C**	1 Circuit	**UNV**	Universal Voltage (120V through 277V)
30K	3000K		*to*	**D00**	1% Dim-to-Off, 0-10V			**347**	347 Volt [8]
35K	3500K	**D200**	2000 (max)	**D05**	SpectraSync 5% Dimming, 0-10V [7]				
40K	4000K			**DS1**	1% Dimming w/ Soft Start, 0-10V				
50K	5000K [3]			**DS0**	1% Dim-to-Off w/ Soft Start, 0-10V				
27K9	2700K, 90 CRI			**LEC**	Hi-lume 1% Ecosystem LED Driver				
30K9	3000K, 90 CRI			**DALI**	DALI [3]				
35K9	3500K, 90 CRI			**DALIP**	Powered by DALI (2.0) [3]				
40K9	4000K, 90 CRI			**NDM**	Non-Dimming				
50K9	5000K, 90 CRI [3]								
2230TD	2200K-3000K SpectraSync™ Dim-to-Warm [6]								
2750T	2700K-5000K SpectraSync™ Tunable White [6]								
2765T	2700K-6500K SpectraSync™ Tunable White [6]								

OPTIONAL

_____ – _____ – _____

Nightlight		Emergency		Thru-wiring	
NL	Nightlight Circuit Required. Enter quantity. 2NL = 2 nightlight circuits/row	**EF**	10W Emergency Battery Pack [5, 10]	**W1**	No Thru Wire
				W2	Provide Normal and Emergency/Nightlight Thru Wiring [10]
				W3	Provide Normal Thru Wiring Only

Control Options [3]	
NX Standalone	
NXS	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount [11, 12, 13]
NX Networked – Wired	
NXE	NX, Dual SmartPorts [11, 12]
NXES	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount, Dual SmartPORTs [11, 12]
NX Networked – Wireless	
NXSW	NX Wireless, PIR BT Occupancy/Daylight Sensor [11, 12, 13]
NXWE	NX Wireless Wireless Enabled [11, 12]
NX Networked – Wired/Wireless	
NXSWD	NX Wireless, PIR BT Occupancy/Daylight Sensor, Dual SmartPORTs [11, 12, 13]
NXWD	NX Wireless, Dual Smart Ports [11, 12]
Sensors	
SD1	Daylight Sensor Required
SO4	Occupancy Sensor Required

Notes:

1 200' max for LITESPEED orders.
2 Visit www.litecontrol.com/finishes for details.
3 Additional lead time may be applicable. Contact factory.
4 Specifiable in 50 lumen increments. Reference the Performance Data Table for full performance offering and exceptions.
5 Some configurations may require drawings for approval.
6 *Must be ordered with D05 Driver option; excludes 2' and 3' lengths; excludes D160-D200 output options
7 Must be ordered with 2230TD, 2750T or 2765T option
8 Excludes Emergency Battery Pack Option and D05, DALI, DALIP and Lutron (LEC) Dimming Drivers.
9 Excludes 2' and 3' lengths and D160-D180 Driver options. LITESPEED limited to D055-D155 outputs.
10 Only applicable when specified with Emergency/Nightlight.

NX In-Fixture Control Options:

11 Not available for row mounting. Only available with 0-10V Driver options. Contact factory for Length restrictions.
12 Refer to NX Integrated Controls Reference Table for Functionality of Options.
13 NX Sensors with Bluetooth, BLE, provides remote commission only.

HUBBELL Lighting

LITECONTROL
making light work™

67L-S-D

NOTE LED SURFACE DIRECT

CONTROLS

NX DISTRIBUTED™ INTELLIGENCE

NX Distributed Intelligence™ Lighting Controls:

Supports both indoor and outdoor applications in a variety of deployment options- wired, wireless, hybrid.
Integrates with and enables a wide array of luminaires including those with SpectraSync Color Tuning Technology.

NX INTEGRATED CONTROLS REFERENCE								
NX Option	Sensor	Networkable	Scheduling	Occupancy	Daylight Harvesting	0–10V Dimming	On/off Control	Bluetooth® App Programming
NX Standalone								
NXS	NXSMP-SMI	No	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wired								
NXE	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R [1]
NXES	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wireless								
NXSW	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NXWE [2]	N/A	Yes	Yes	No	No	Yes	Yes	No [3]
NX Networked – Wired/Wireless								
NXSWD	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NXWD	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R [1,3]

1 NXBTC/R needs to be plugged into an available NX SmartPort™ on the fixture network
2 Programming via App requires factory assistance
3 To program NXWE option, need to consult factory. If connected to an area controller, programming can be done from that

SpectraSync™ Color Tuning Technology:

Control your space based on the needs of the application, specific activities throughout the day and preferences of the occupants with distinct SpectraSync™ Color Tuning Technologies.

SpectraSync™ Color Tuning Technology

SPECTRASYNC COLOR TUNING TECHNOLOGY		
Mode	Kelvin Range	Description
Dim to Warm	2200K-3000K	Mimics the familiar warming effect that occurs with traditional incandescent sources as they are dimmed
Tunable White	2700K-5000K 2700K-6500K	Offers users the ability to tailor CCT to their personal preference, enhancing task visibility, material and colors or the aesthetics of the space
Scheduled White	2700K-5000K 2700K-6500K	Mimics the rhythm of natural light or follows an alternative user-defined schedule throughout the day, enhancing an occupant's mood and well-being

NX Design & Application Guide
NX Brochure
SpectraSync
NX Solutions Guide

HUBBELL® HUBBELL Lighting

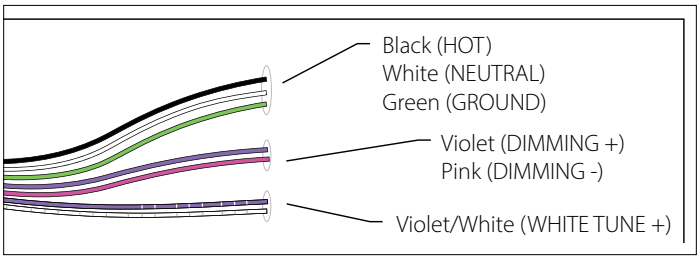
67L-S-D

NOTE LED SURFACE DIRECT

CONTROLS CONTINUED

SpectraSync Tunable White

Available in two options: 2750T (2700K–5000K) or 2765T (2700K–6500K).
Requires two 0–10V controllers, one for intensity and one for CCT.
Minimum 5% dimming.

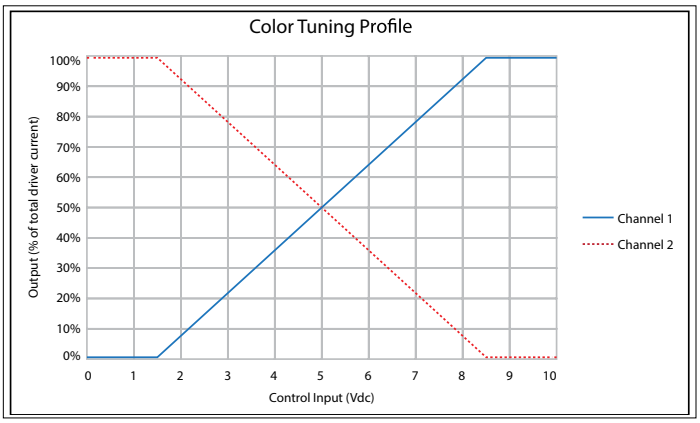


SpectraSync Tunable White luminaires are provided with two 0–10V circuits. The violet and pink circuit is for wiring to any qualified 0–10V controller for dimming. The violet/white and grey/white circuit is for wiring to any qualified 0–10V controller for Tunable White CCT control.

Controller Manufacturer Data

SpectraSync Tunable White was designed to be used with sinking style dimmers (provided by others) and is compatible with:

- Hubbell Control Solutions (HCS): NX Distributed Intelligence™ Room Controllers (NXRC) and In-fixture Controllers (NXFM)
- Lutron: DVTV, DVSTV, and NFTV dimmers
- Wattstopper: ADF120277 and CD4BL (Titan) dimmers



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PERFORMANCE DATA TABLE

The table below shows the delivered lumens for the various lumen outputs. Use this chart in connection with the output multiplier capability to deliver any output required.

Nomenclature	Lumens/Ft	W/Ft	Efficacy
D055	550	4.2	130
D060	600	4.7	128
D065	650	4.9	132
D070	700	5.4	131
D075	750	5.8	129
D080	800	6.0	133
D085	850	6.5	131
D090	900	6.7	134
D095	950	8.0	118
D100	1000	8.5	118
D105	1050	8.7	121
D110	1100	8.9	123
D115	1150	9.2	126
D120	1200	9.4	128
D125	1250	9.6	130
D130	1300	9.8	132
D135	1350	10.1	134
D140	1400	10.6	132
D145	1450	11.2	129
D150	1500	11.6	129
D155	1550	11.8	131
D160	1600	12.5	128
D165	1650	12.7	130
D170	1700	13.6	125
D175	1750	14.1	124
D180	1800	14.3	126
D185	1850	14.7	126
D190	1900	15.0	127
D195	1950	15.3	127
D200	2000	15.7	128

(Data shown is for a Dome Lens fixture. Wattage may vary up to 5% from published)

Output Multiplier Table

Photometrics for the 67L are published here at a nominal 3500K temperature. This table may be used to approximate the lumen values at different Kelvin temperatures. Power consumption would stay the same.

Option	2700K	3000K	3500K	4000K	5000K	2700K 90 CRI	3000K 90 CRI	3500K 90 CRI	4000K 90 CRI	5000K 90 CRI
Multiplier	0.95	0.98	1.00	1.03	1.05	0.83	0.85	0.88	0.90	0.93

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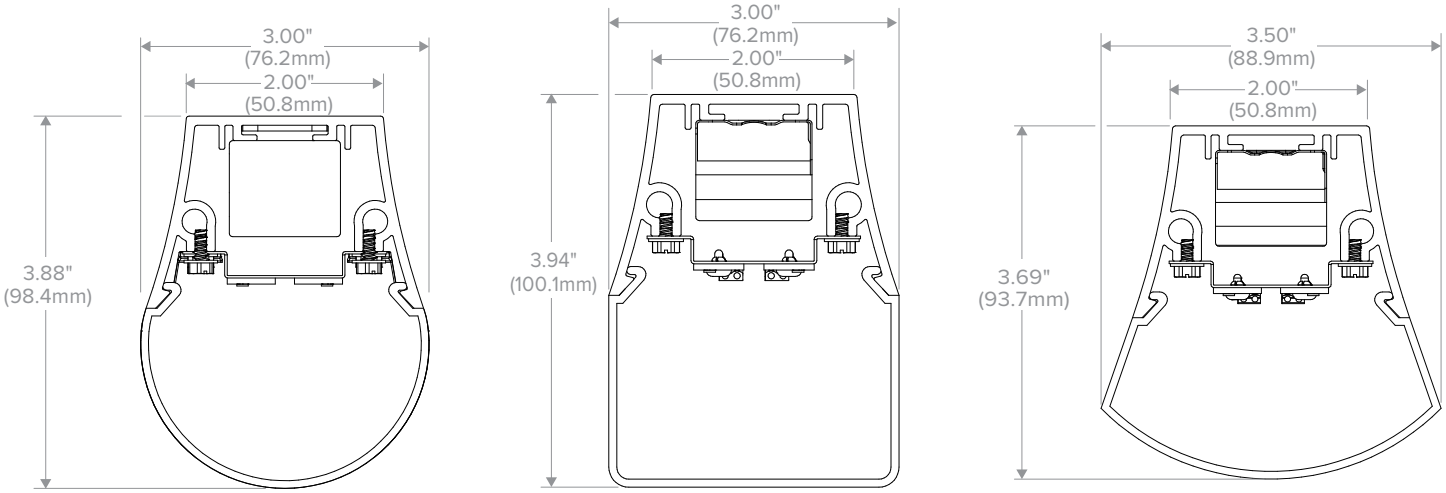
NOTE LED SURFACE DIRECT

DIMENSIONS



Dome

Square

Bell

PHOTOMETRY

67L-S-D-4-DM-X-CX-35K-D145

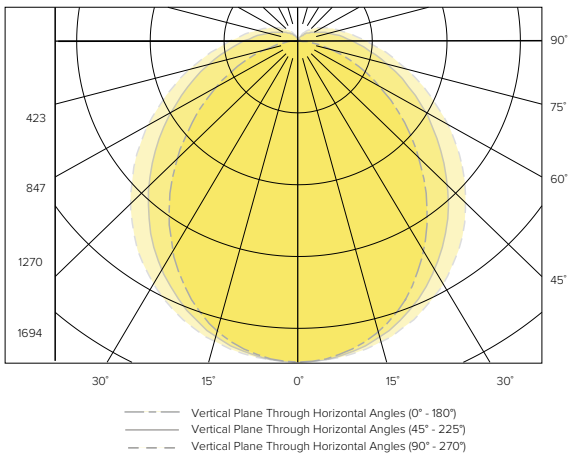
LUMINAIRE DATA

Test No.	**RITL90383-01**
Description	**67L Note Dome Pendant Direct**
Delivered Lumens	**5800**
Watts	**41.1W**
Efficacy	**141**
Mounting	**Pendant**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–40	2129	36.7
0–60	3754	64.7
0–90	5197	89.6
0–180	5800	100.0

POLAR GRAPH



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NOTE LED SURFACE DIRECT

PHOTOMETRY CONTINUED

67L-S-D-4-BL-X-CX-35K-D125

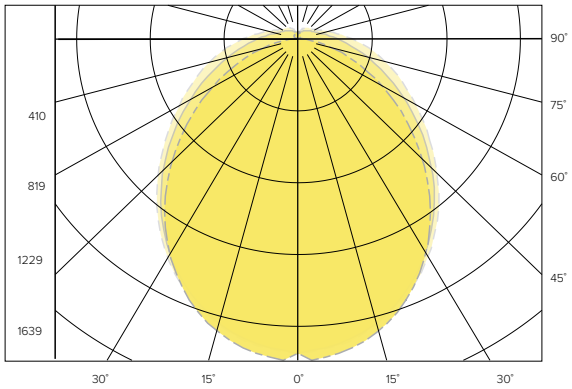
LUMINAIRE DATA

Test No.	**R16.01192-01**
Description	**67L Note Bell Pendant Direct**
Delivered Lumens	**5000**
Watts	**38.4W**
Efficacy	**130**
Mounting	**Pendant**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–40	1962	39.2
0–60	3364	67.3
0–90	4503	90.1
0–180	5000	100.0

POLAR GRAPH



67L-S-D-4-SQ-X-CX-35K-D055

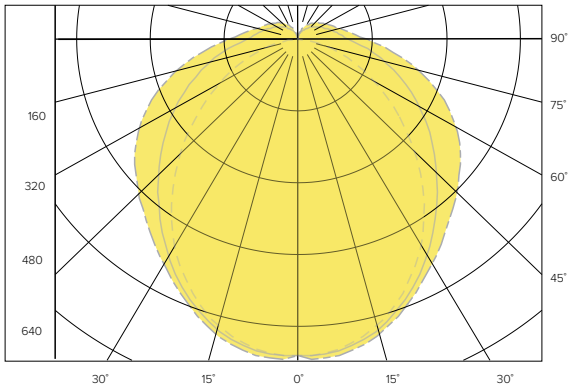
LUMINAIRE DATA

Test No.	**R17.02611-01**
Description	**67L Note Square Pendant Direct**
Delivered Lumens	**2200**
Watts	**17.0W**
Efficacy	**130**
Mounting	**Pendant**

ZONAL LUMEN SUMMARY

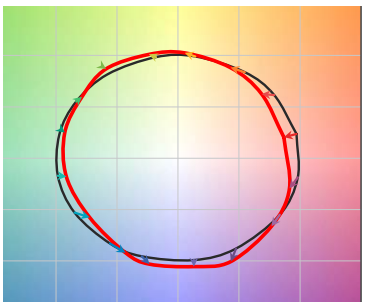
Zone	Lumens	% Luminaire
0–40	776	35.3
0–60	1368	62.2
0–90	1926	87.5
0–180	2200	100.0

POLAR GRAPH



TM-30 DATA

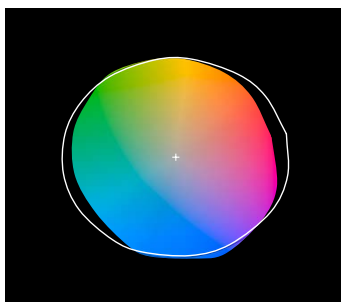
COLOR VECTOR GRAPHIC



*Graphics shown are at 35K

Reference Illuminant Test Source

COLOR DISTORTION GRAPHIC



TEST RESULTS - 3500K	
Value	80+ CRI
CCT (K)	3479
CIE R_a	83
D_{UV}	-0.0009
R_f	82
R_g	98
x	0.4055
y	0.3888

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ADDITIONAL INFORMATION

Output (VI Technology)

Variable Intensity (VI) technology allows precise specification of fixture output/wattage. Fixture will be programmed and labeled to specification. See output section for available increments.

Driver

D01	100%- 1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
D00	Dim-to-Off 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
D05	100%-5% dimming range, Fixture will be wired for low voltage 0-10V dimming control. Only applicable if either 2230TD, 2750T or 2765T is selected.
DS1	Soft-Start 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
DS0	Soft-Start Dim-to-Off 100%-1% dimming range. Fixture will be wired for low voltage 0-10V dimming control.
LEC	Hi-Lume 1% EcoSystem LED Driver with Soft-On, Fade-to-Black dimming technology.
DALI	DALI compatible.
DALIP	Self-Powered DALI bus (e.g. DEXAL)
NDM	Non-dimming. Fixture will be wired for fixed light output.

Rated Life

Test in accordance to the LM79-2008 and derived from EPA TM-21 calculator
L70: 257,000 (calculated per TM-21 extrapolated curve)
L70: >61,000 (reported per TM-21/LM80 6x's limitation)
L90: 66,000 (calculated per TM-21 extrapolated curve)
L90: >61,000 (reported per TM-21/LM80 6x's limitation)

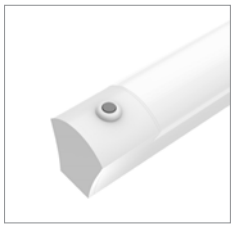
Fixture Weight

2 lbs/ft.

Sensor

SD1	Daylight sensor (Wattstopper part #FD301). Installs on integrated sleeve.
SO4	Occupancy sensor (Wattstopper part #FS205). Installs on integrated sleeve.

See separate LC-Controls spec sheet for additional details.



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By PCM3 at 12:54 pm, April 27, 2023

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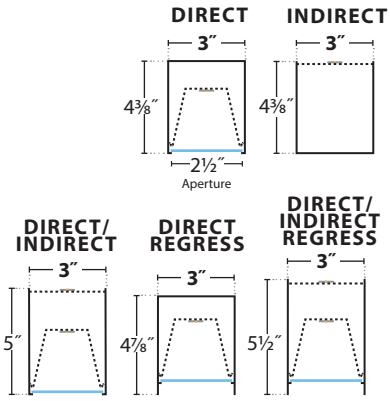


Lumen output may vary +/– 5%
Light Loss Factor (LLF) for CCTs other than 3500K:
4000K +2%, 3000K -5%, 2700K -20%
90 CRI -15% (3K, 3500K, 4K & 5K
White Louver -30% LLF, Silver -50%, Black -70%
ADC -2% LLF

See LED Details PDF for more info

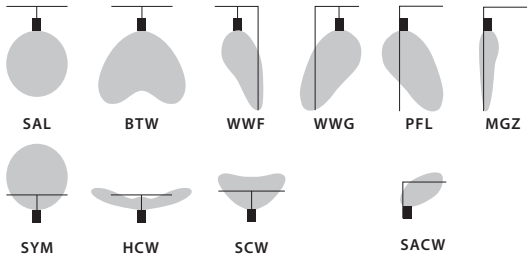
FLSH: UPTO **121** LPW

DIRECT:		LO	MO	SO	HO
SAL	Lm/Ft	435	640	885	1100
BTW	Lm/Ft	470	685	950	1200
WWF	Lm/Ft	475	700	975	1225
WWG / PFL	Lm/Ft	475	700	975	1225
MGZ	Lm/Ft	475	700	975	1225
	W/Ft	3.8	5.6	7.8	10.5
INDIRECT:		**LO**	**MO**	**SO**	**HO**
SYM	Lm/Ft	625	825	1075	1375
HCW	Lm/Ft	300	450	625	775
SCW	Lm/Ft	575	875	1170	1450
SACW	Lm/Ft	500	750	1000	1200
	W/Ft	3.8	5.6	7.8	10.5
DIRECT / INDIRECT:					
	W/Ft	7.6	11.2	15.6	21

LUMEN CHART AT 3500K-80 CRI
SEE PAGES 4 FOR REGRESS

SEAMLESS · Declare · DLC QPL LISTED · UGR16 WELL Building Standard · LED WARRANTY 5 YEAR · LED Details · Made in the USA

SERIES	LENS POS.	LED COLOR	OUTPUT	NOM. LENGTH	FINISH COLOR	LOUVER COLOR	DISTRIBUTION	UP OPTIONS	CIRCUITING	VOLTAGE	MOUNTING	CEILING SYSTEMS	DRIVERS	OPTIONS & CONTROL SENSORS
BPro3-Lin			—				—							
Bionic Pro3 Linear	FLSH Flush Lens LVR ½″ Regress with Louver REG.5 ½″ Regress IND Indirect Only (Select NW No Downligh **NOTE:** Louvers currently NA with corners, consult factory	LED27 2700K (90CRI) LED3 3000K LED35 3500K LED4 4000K LED3-90 3000K (90CRI) LED35-90 3500K (90CRI) LED4-90 4000K (90CRI) LED5-90 5000K (90CRI)	LO Low MO Medium SO Standard HO High PROG Programmable Light Output (Specify desired lm/ft or w/ft) **SPECIFY DOWN THEN UP IF DIFFERENT OUTPUT DESIRED**	2´ 3´ 4´ 5´ 6´ 7´ 8´ R___ (Row Length, 1´ increments) SRL Symmetric Row Length (See page 12) **NOTE:** Individual fixtures are NOT intended for row mounting	TMW Textured Matte White (Standard) YGW Gloss White Y__ Premium Color CC Custom Color **NOTE:** All canopies are painted the same color as the fixture. Consult factory to specify	YBK Black Matte (Standard) TMW Textured Matte White YGW Gloss White Y__ Premium Color CC Custom Color	**CHOOSE DOWN –AND– UP** **DOWN:** NW No Downlight SAL Satin Lens BTW Batwing WWF Flat Wall Wash WWG Focal Glow Wall Wash PFL Perimeter Room Fill MGZ Medium Wall Graze **UP:** NU No Uplight HCW Hard Ceiling Wash SYM Symmetric (Frosted ADC standard) SCW Soft Ceiling Wash SACW Soft Asymmetric Ceiling Wash	TG Top Glow ADC Acrylic Dust Cover (Clear) Standard for SYM (Frosted) TGADC Top Glow with Acrylic Dust Cover **UP OPTIONS AVAILABLE WITH ANY UP DISTRIBUTION**	SC Single Circuit (Down & Up will dim together) DC Dual Circuit (Needed if dimming Down separately from Up)	UNV (120-277) 347 (Emergency battery requires remote driver box)	CA48″, 96″ or 144″ Aircraft Cable (Adjustable) SUR Surface Mount (Direct only) WM Direct to Wall WS ½″ Wall Spacer WS2 2″ Wall Spacer WBx.x Wall Bracket (2″-6″ in .5″ increments, 3″ standard if not specified)	X1 T-Bar X3 Hard Ceiling X6 Slot Grid	ND Non-Dimming DM01 0-10v, 1% Dimming (Standard) LDE1 Hi-lume 1% EcoSystem LED (Soft fade on, fade-to-black dimming) ECO 1% 0-10v, EldoLED (Logarithmic dimming std) ECDA 1% DALI, EldoLED (Logarithmic dimming std) SOLO 0.1% 0-10v, EldoLED (Dim-to-dark, Logarithmic dimming std) SODA 0.1% DALI, EldoLED (Dim-to-dark, Logarithmic dimming std) STEP Signify Advance Step Dimming	EMHE CA T20 Emergency Battery (1250 Delivered lumens; CA Title 20 compliant) ETS-DR Iota ETS-DR Emergency Transfer Switch EMC Emergency Circuiting EBCP1G /2G Single / Dual Gang (Electrical Box Cover Plate/Mud Ring) PIF Pre-installed Individual Fixture (Saves time on individual fixture installs, see page 5) **SENSORS:** 205 WattStopper PIR Occupancy **205-ON/OFF** **205-STEP:** Dim to 50% **205-DM:** Dim to 1% ENL Enlighted SU-5E-IOT LUX Phillips DL LVOC‡‡ Lutron Vive (Occ & RF) LVRF‡‡ Lutron Vive (RF Only) NXSMP Hubbell (Occ) ‡‡ Requires Lutron driver **CORNERS:** C2-60 Lit 60° C2-90 Lit 90° C2-120 Lit 120° C2-135 Lit 135° C3T Lit 90° 3-Way: **T** C3Y Lit 120° 3-Way: **Y** C4T Lit 90° 4-Way: **+** C4X Lit 45°-135° 4-Way: **X** C8I Lit Inside 2-Plane C8O Lit Outside 2-Plane LRT Linear to Recessed Transition (Straight rows only)



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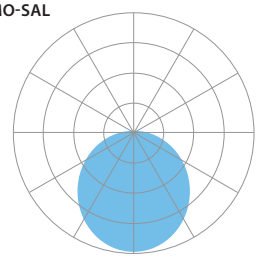
FLSH:

SATIN LENS

MEDIUM OUTPUT:
BPRO3-LIN-FLSH-LED35-MO-SAL

2566 Delivered Lumens
23 Watts
113 lm/w
3500 CCT
1.24 Spacing Criteria


940

Zonal Lumen Summary:
0-90 = 100%

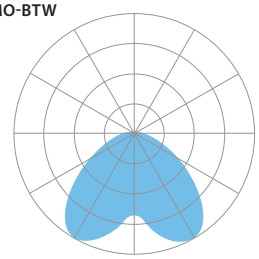
Vertical Angle	0°	25°	45°	65°	90°
0°	940	940	940	940	940
5°	933	934	930	936	938
15°	890	891	890	897	899
25°	808	810	812	823	826
35°	702	704	708	720	724
45°	580	581	585	596	602
55°	448	449	453	460	466
65°	310	311	314	319	325
75°	174	174	177	180	185
85°	45	45	48	50	52
90°	0	0	0	0	0

BATWING

UGR16
WELL Building Standard

MEDIUM OUTPUT:
BPRO3-LIN-FLSH-LED35-MO-BTW

2747 Delivered Lumens
23 Watts
121 lm/w
3500 CCT
1.84 Spacing Criteria


1096

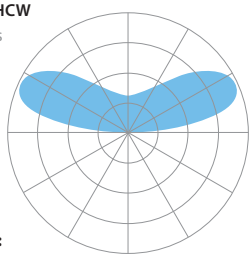
Zonal Lumen Summary:
0-90 = 100%

Vertical Angle	0°	25°	45°	65°	90°
0°	690	690	690	690	690
5°	734	727	705	690	684
15°	971	932	819	688	630
25°	1096	1058	910	667	541
35°	1029	1018	903	609	447
45°	796	820	787	512	365
55°	540	566	587	393	295
65°	337	352	371	273	226
75°	178	184	192	162	148
85°	49	50	54	53	53
90°	0	0	0	0	0

HARD CEILING WASH

STANDARD OUTPUT:
BPRO4-LED35-SO-NW-HCW

2504 Delivered Lumens
33 Watts
86 lm/w
3500 CCT


958

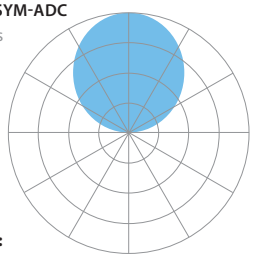
Zonal Lumen Summary:
90-180 = 100%

Vertical Angle	0°	22.5°	45°	67.5°	90°
90°	0	0	0	0	0
95°	40	44	57	89	27
105°	557	564	455	243	101
115°	958	846	572	309	178
125°	900	793	558	336	241
135°	718	644	489	346	285
145°	548	507	425	347	314
155°	437	420	382	346	332
165°	376	370	356	346	342
175°	348	347	345	346	348
180°	345	345	345	345	345

SYMMETRIC

STANDARD OUTPUT:
BPRO3-LED35-SO-NW-SYM-ADC

4472 Delivered Lumens
33 Watts
136 lm/w
3500 CCT


1787

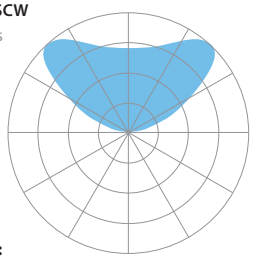
Zonal Lumen Summary:
90-180 = 100%

Vertical Angle	0°	22.5°	45°	67.5°	90°
90°	0	0	0	0	0
95°	68	68	69	69	72
105°	245	246	256	258	259
115°	490	490	496	490	495
125°	756	757	762	753	767
135°	1035	1035	1026	1037	1051
145°	1291	1291	1294	1309	1323
155°	1521	1521	1520	1534	1549
165°	1681	1681	1677	1690	1706
175°	1761	1761	1756	1770	1787
180°	1775	1775	1775	1775	1775

SOFT CEILING WASH

STANDARD OUTPUT:
BPRO3-LED35-SO-NW-SCW

4639 Delivered Lumens
33 Watts
143 lm/w
3500 CCT


1584

Zonal Lumen Summary:
90-180 = 100%

Vertical Angle	0°	22.5°	45°	67.5°	90°
90°	0	0	0	0	0
95°	102	123	161	136	48
105°	367	409	463	344	198
115°	755	804	824	539	369
125°	1270	1283	1117	701	539
135°	1584	1492	1179	823	700
145°	1484	1381	1138	921	851
155°	1279	1220	1102	1005	978
165°	1149	1130	1094	1074	1073
175°	1114	1111	1106	1114	1123
180°	1117	1117	1117	1117	1117

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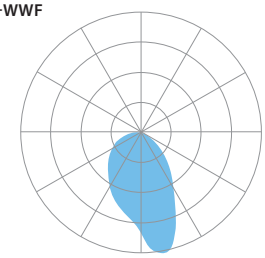
FLUSH:

FLAT WALL WASH

Standard Output:
BPRO3-FLSH-LED35-LO-4-WWF

1923 Delivered Lumens
15.40 Watts
125 lm/w
3500 CCT



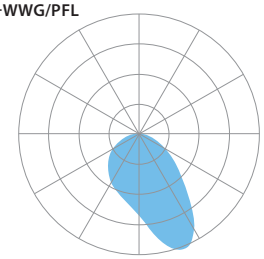
Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	20	20	24	26	26
	75°	69	72	88	92	88
	65°	134	141	178	191	174
	55°	227	244	309	363	323
	45°	371	398	490	613	500
	35°	577	612	748	862	636
	25°	890	936	1056	994	732
	15°	1224	1221	1154	977	797
	5°	994	982	934	883	831
	0°	834	834	834	834	1714
ROOM SIDE	5°	742	747	758	788	831
	15°	649	654	666	705	797
	25°	538	551	580	625	732
	35°	422	432	463	525	636
	45°	329	336	353	399	500
	55°	243	245	250	264	323
	65°	169	165	159	155	174
	75°	97	95	87	81	88
	85°	24	26	24	24	26
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

FOCAL GLOW WALL WASH / PERIMETER FILL

Low Output:
BPRO3-FLSH-LED35-LO-4-WWG/PFL

1901 Delivered Lumens
15 Watts
126 lm/w
3500 CCT



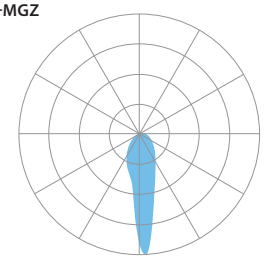
Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	22	22	27	29	30
	75°	75	80	103	104	95
	65°	155	169	226	211	162
	55°	284	312	423	374	249
	45°	494	546	678	555	359
	35°	827	868	885	691	475
	25°	1059	1039	940	767	584
	15°	992	971	893	788	669
	5°	818	815	786	754	715
	0°	720	720	720	720	720
ROOM SIDE	5°	626	635	647	677	715
	15°	523	528	540	582	669
	25°	466	470	474	496	584
	35°	408	409	411	417	475
	45°	351	348	341	335	359
	55°	285	281	263	244	249
	65°	210	203	180	159	162
	75°	121	120	101	90	95
	85°	33	35	30	28	30
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

MEDIUM WALL GRAZER

LOW OUTPUT:
BPRO3-FLSH-LED35-LO-4-MGZ

1930 Delivered Lumens
15 Watts
128 lm/w
4000 CCT



Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	24	22	21	23	26
	75°	81	76	75	84	90
	65°	138	133	140	170	183
	55°	200	199	222	304	369
	45°	276	281	320	474	696
	35°	373	384	437	680	1139
	25°	498	515	600	994	1600
	15°	729	765	968	1542	1929
	5°	1756	1771	1925	2097	2076
	0°	2086	2086	2086	2086	2086
ROOM SIDE	5°	1384	1476	1615	1858	2076
	15°	642	677	806	1229	1929
	25°	475	491	550	813	1600
	35°	363	379	418	585	1139
	45°	263	276	315	426	696
	55°	187	194	219	284	369
	65°	132	129	140	165	183
	75°	82	78	75	83	90
	85°	23	25	22	24	26
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

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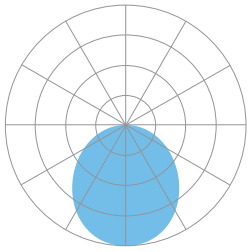
REG.5:

SATIN LENS

STANDARD OUTPUT:
BPRO3-LIN-REG.5-LED35-SO-SAL

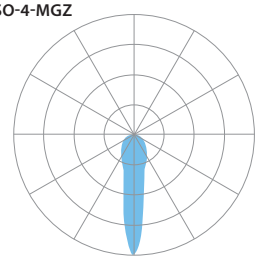
3342	Delivered Lumens
31	Watts
109	Lm/W
3500	CCT



MEDIUM WALL GRAZER

STANDARD OUTPUT:
BPRO3-LIN-REG.5-LED35-SO-4-MGZ

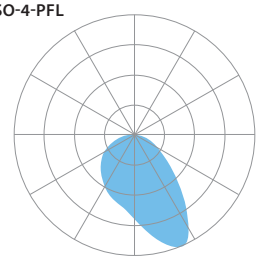
3705	Delivered Lumens
31	Watts
120	Lm/W
3500	CCT
16°	FWHM



PERIMETER FILL

STANDARD OUTPUT:
BPRO3-LIN-REG.5-LED35-SO-4-PFL

3591	Delivered Lumens
33	Watts
117	Lm/W
3500	CCT



UPTO **120** LPW

REG.5:		LO	MO	SO	HO
SAL	Lm/Ft	425	625	840	1100
BTW	Lm/Ft	435	640	885	1115
WWF	Lm/Ft	450	670	900	1175
WWG/PFL	Lm/Ft	450	670	900	1175
MGZ	Lm/Ft	460	685	925	1200
	W/Ft	4	6	8	10.5

LUMEN CHART AT 3500K-80 CRI

Consult factory for Louver IES: *marketing@prulite.com*

LUMEN MAINTENANCE

L70 — 200,000+ Hours
L90 — 100,000+ Hours (LO, MO & SO)
L90 — 60,000+ Hours (HO)

LED SYSTEM LED modules and drivers are field replaceable.

PROG (OPTIONAL) Programmable light output. Specify desired lumens or watts per linear foot.

BINNING Standard binning (all Prudential LED boards) includes testing at the chip level and board integration to provide consistent color temperature within a 3-step MacAdams ellipse, with +/- 5% lumen output range and +/- .004 Duv.

LABELS CSA and ETL damp labeled and I.B.E.W. manufactured.

ELECTRICAL Must specify LED dimming controls. LED fixtures have constant current driver(s) with less than 20% THD when loaded to a minimum of 60%. Drivers sink a maximum of 6mA per driver. DM01 LED drivers are 0-10V dimmable and are compatible with most 0-10V wall slide dimmers and direct 0-10V analog signal dimmers. Max driver size 1.65″ w x 1.25″ h.

CONSTRUCTION

Housing Extruded aluminum housing and side wall >25% PC recycled, 100% recyclable.

Lens Seamless lens up to 200′. Consult factory for longer lengths. Polymer, 100% recyclable.

Weight 3.5 lbs/ft

MOUNTING Surface mounted to walls or ceilings, wall spacer, wall bracket to wall, suspended by cable.

WARRANTY Single-source, 5 year limited warranty covers standard components and construction.

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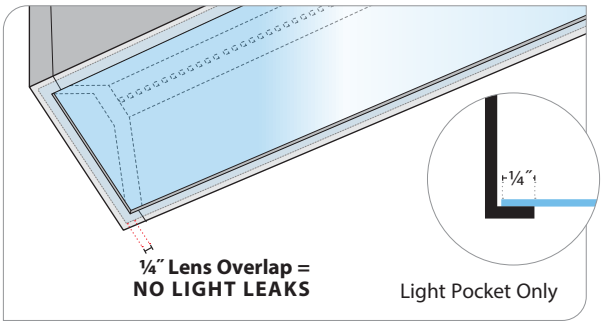
YSW – Seashell White (Matte)
YCH – Champagne (Metallic)
YSL – Silver (Metallic)
YPE – Pewter (Matte)
YRG – Rain Grey (Gloss)
YSTM – Storm Grey (Matte)
YBK – Black (Matte)
YBB – Black (Semi Gloss)
YSKM – Sky (Matte)
YMB – Military Blue (Matte)
YIB – Interstate Blue (Matte)
YSAM – Sapphire (Matte)
YFGM – Forest Green (Matte)
YBR – Bronze (Matte)
YBY – Boysenberry (Matte)
YSRM – Sunset Red (Matte)
YOR – Orange (Matte)
YDAM – Daffodil (Matte)

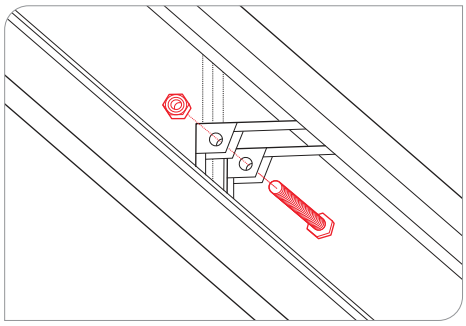
Choose from one of our Premium Colors with no set-up fee.

For paint chip samples, please email:
info@prulite.com

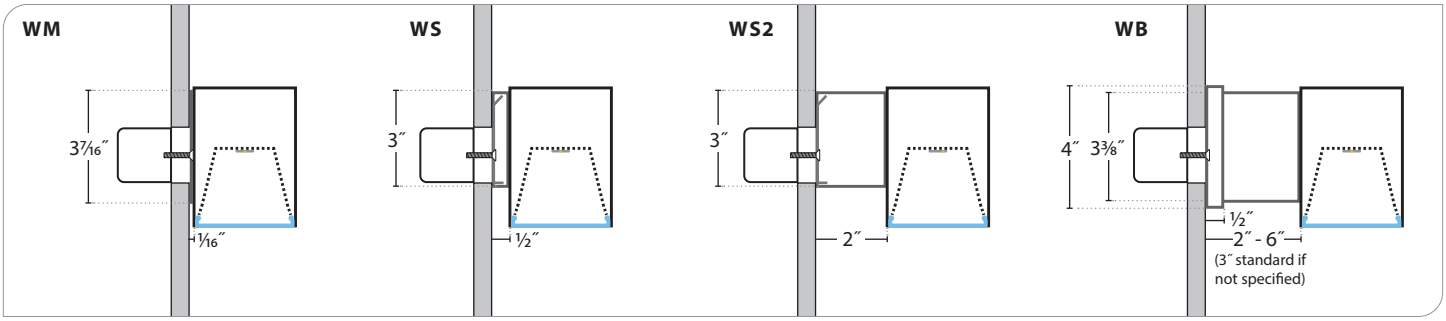
CAST ALUMINUM END CAPS



ADJOINING DETAILS

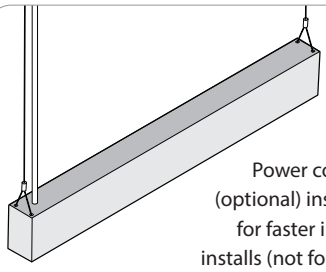


WALL CROSS SECTIONS



FIXTURE SIZE VARIES

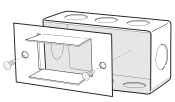
PIF — PRE-INSTALLED INDIVIDUAL FIXTURE



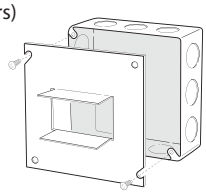
Power cord, lens, louvers (optional) installed at factory for faster individual fixture installs (not for row mounting)

EBCP — ELECTRICAL BOX COVER PLATE

OPTIONAL: ⅞″ Dia. K.O. will accommodate 2″x 4″ or 4″x 4″ J-Box (by others)



1G: SINGLE GANG



2G: DUAL GANG

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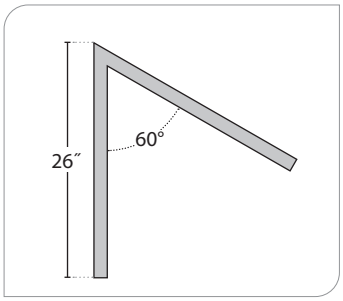
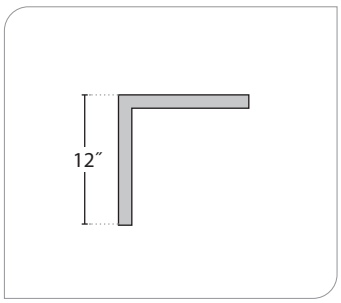
CORNERS

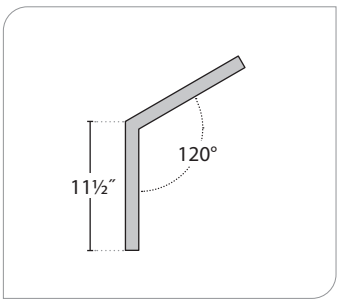
C2-60:



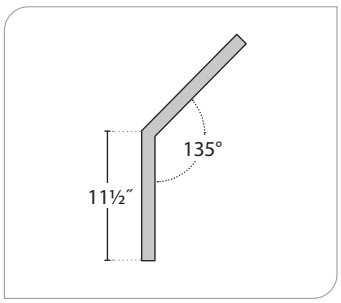
C2-90:



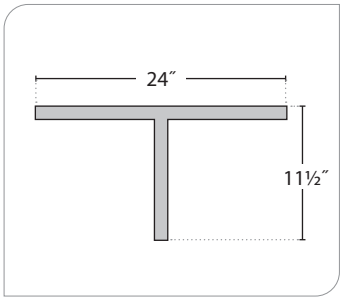
C2-120:



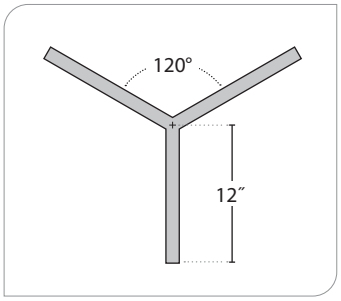
C2-135:



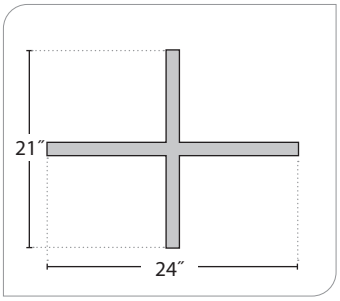
C3T:



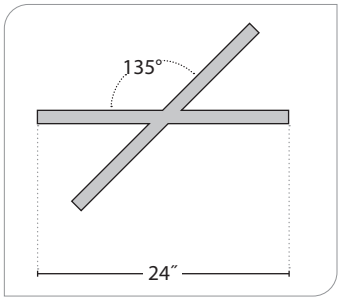
C3Y:



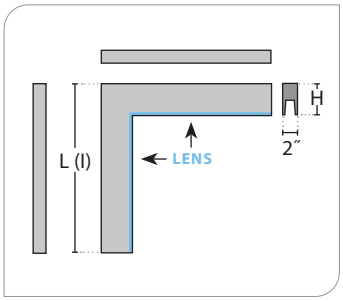
C4T:



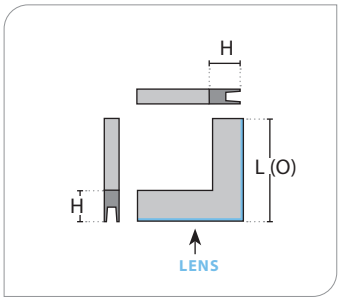
C4X:



C8I:

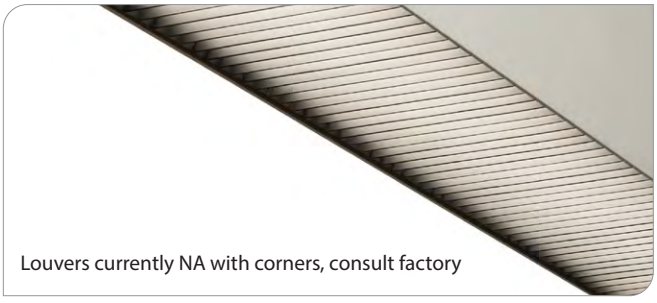


C8O:



BODY TYPE	DIM "H"	DIM "L" (I)	DIM "L" (O)
Direct Flush	4 ⅜″	16 ⅜″	12″
Direct Regress	4 ⅞″	16 ⅜″	12 ½″
Direct/Indirect Flush	5″	17″	12″
Direct/Indirect Regress	5 ½″	17″	12 ½″

LOUVER DETAIL



Louvers currently NA with corners, consult factory

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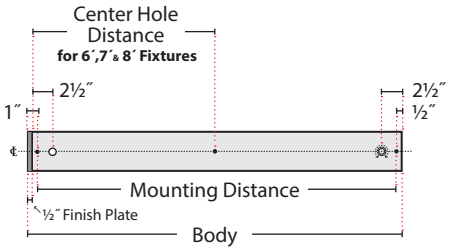
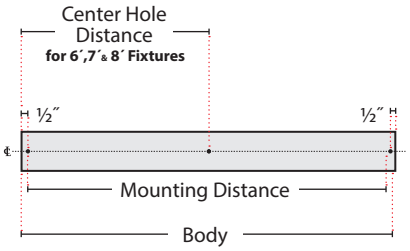
MOUNTING LOCATIONS:

SURFACE

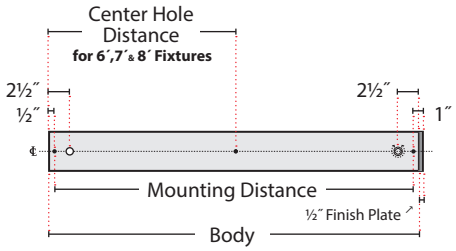
START:



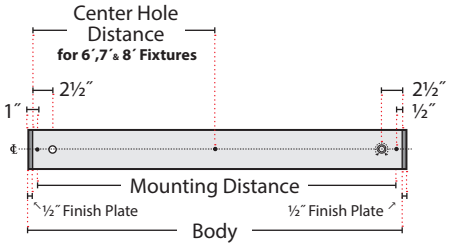
INTERMEDIATE:



END:



INDIVIDUAL:



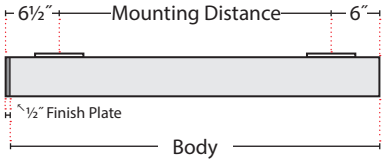
	MOUNTING	BODY*	CENTER HOLE
2´	23″	24″	—
3´	35″	36″	—
4´	47″	48″	—
5´	59″	60″	—
6´	71″	72″	36″
7´	83″	84″	42″
8´	95″	96″	48″

● 5⁄16″ Ø Mounting Hole ○ 15⁄16″ Ø Power Feed Hole ◎ 15⁄16″ Ø Power Feed K.O.

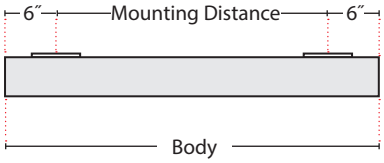
* For overall dimensions add finish plate(s) where required

WALL

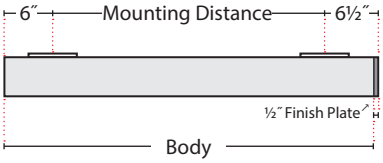
START



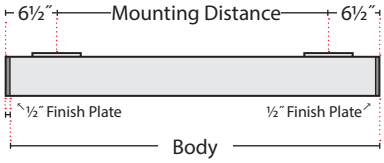
INTERMEDIATE



END



INDIVIDUAL



	MOUNTING	BODY*
2´	12″	24″
3´	24″	36″
4´	36″	48″
5´	48″	60″
6´	60″	72″
7´	72″	84″
8´	84″	96″

* For overall dimensions add finish plate(s) where required

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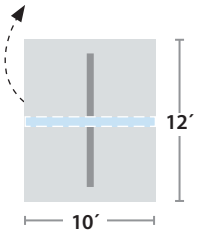
BionicPro3 Batwing Vs. Top 3" Competitor (Satin Lens)

SINGLE OFFICE

BionicPro3

36 43 46 44 39 39 44 47 43 37



Top Competitor

22 28 36 44 52 52 44 36 28 22

	BionicPro3	Competitor
LPW	121	111
SPACING CRITERIA	**1.8**	**1.3**
MAX/MIN	1.8	2.6
W/SQ. FT.	.38	.43
FC AVERAGE	26	30

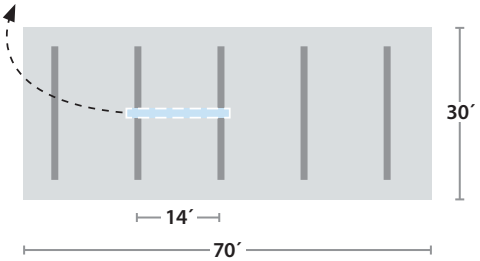
9´ ceiling .85 llf BionicPro3— 5.7w/ft Competitor—6.5w/ft Footcandles at 30" working plane

OPEN OFFICE

BionicPro3

39 43 47 47 44 39 36 35 36 40 44 47 47 43 39

14´



Top Competitor

74 68 58 47 38 32 28 27 28 32 38 47 58 68 74

14´

	BionicPro3	Competitor
LPW	121	111
SPACING CRITERIA	**1.85**	**1.3**
MAX/MIN	2.2	4.4
MAX/MIN BETWEEN ROWS	1.3	2.8
W/SQ. FT.	.37	.41
FC AVERAGE	35	37

9´ ceiling .85 llf BionicPro3— 5.7w/ft Competitor—6.5w/ft Footcandles at 30" working plane

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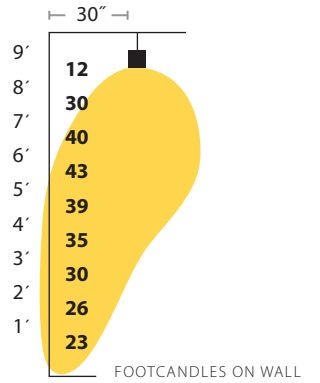
PRULITE.COM 213.746.0360

Smooth, flat wall washing (WWF)

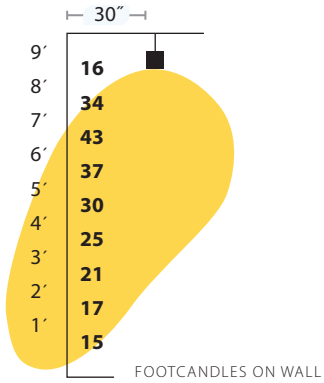
Our patent-pending TruBeam™ optics redirect light in an ideal flat wall wash for smooth, even illumination.



	Watts/ Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Medium Output | 700 lumens/ft	6	9′	**31 fc**	43/12	3.6

Focal glow wall washing (WWG)

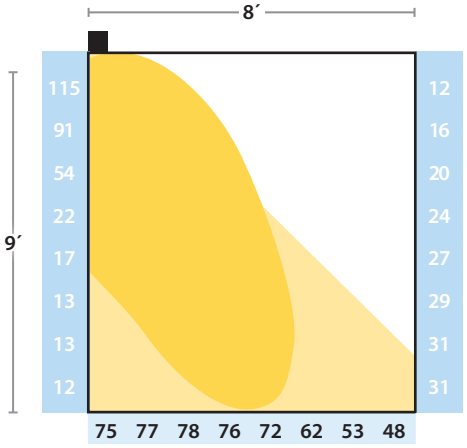
Pique interest by giving works of art 'pop' — more light at eye level



	Watts/ Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Medium Output | 700 lumens/ft	6	9′	**26 fc**	43/15	2.9

Perimeter Fill (PFL)

Wash a corridor in light from one side of the perimeter. Our Perimeter Fill is ideal for hospital corridors where a 50 fc average is needed.

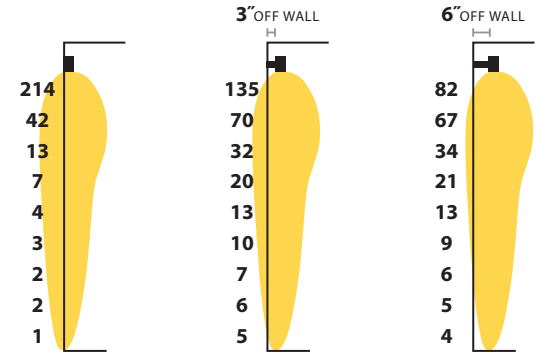


	Watts/ Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
High Output | 1225 lumens/ft	1.75	10′	**50 fc**	67/55	1.2

Medium Wall Graze

Wall grazing performance often better just off a wall.

DIRECT TO WALL (WM) **WALL BRACKET (WB)**



See perimeter specs

USE WB WALL BRACKET FOR BETTER PERFORMANCE THAN FLUSH TO WALL

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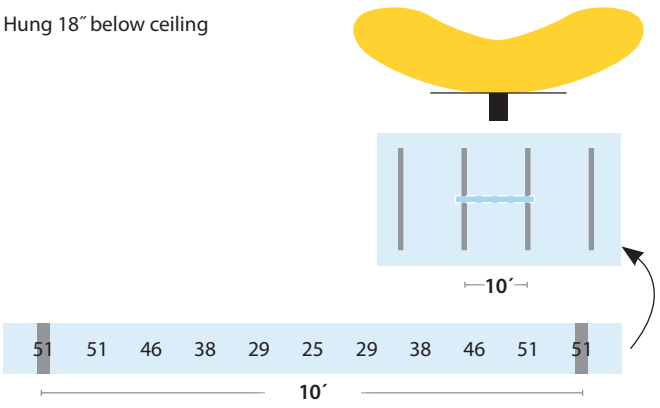
Hard ceiling wash (HCW)

OPEN OFFICE/CLASSROOM

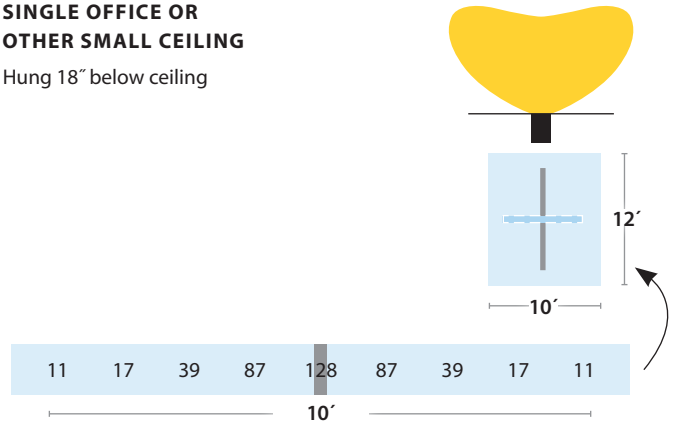
Hung 18˝ below ceiling



Soft ceiling wash (SCW)

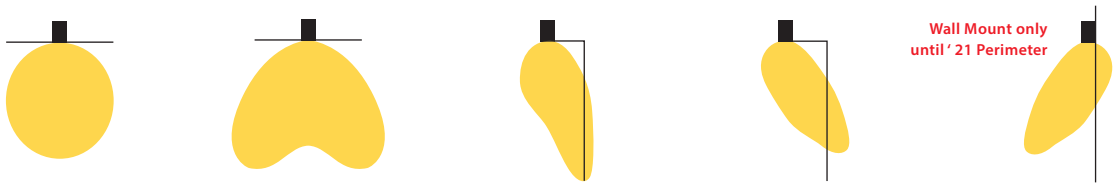
SINGLE OFFICE OR OTHER SMALL CEILING

Hung 18˝ below ceiling



BionicPro to Bionic/P23-43 Optics Crossing Matrix

DOWNLIGHT:



	Satin	Batwing	Flat Wall Wash	Focal Glow Wall Wash	Perimeter Fill
BionicPro	SAL	BTW	WWF	WWG	PFL
Bio2 / P23 = BionicPro3	SAL	MBW	MWW/D1W	—	MWW/D1R
Bionic4 / P43 = BionicPro4	SAL	ABW/D1X	—	AWL/D1W	AWL/D1R

UPLIGHT:

WWG = PFL
Lens aimed away from wall

	Symmetric	Ceiling Wash	Soft Ceiling Wash	Asymmetric Ceiling Wash
BionicPro	SYM	HCW NA BionicPro2	SCW	SACW
Bio2 / P23 = BionicPro3	SYM	CW	—	ACW
Bionic4 / P43 = BionicPro4	SYM	CW	—	—

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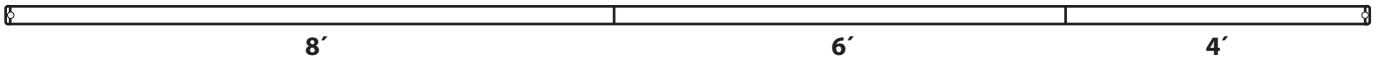
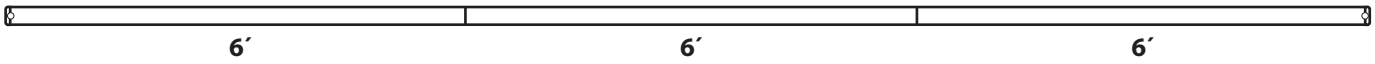
18´ STANDARD ROW LENGTH:



18´ SYMMETRIC ROW LENGTH (SRL):



ROW LENGTH	STANDARD ROW LENGTH	SYMMETRIC ROW LENGTH (SRL)
9´	5+4	3+3+3
10´	6+4	5+5
11´	7+4	4+3+4
12´	8+4	6+6
13´	8+5	4+5+4
14´	8+6	7+7
15´	8+7	5+5+5
16´	8+8	8+8
17´	8+5+4	6+5+6
18´	8+6+4	6+6+6
19´	8+7+4	6+7+6
20´	8+8+4	8+4+8
21´	8+8+5	8+5+8
22´	8+8+6	8+6+8
23´	8+8+7	8+7+8
24´	8+8+8	8+8+8
25´	8+8+5+4	6+4+5+4+6
26´	8+8+6+4	8+5+5+8
27´	8+8+7+4	6+5+5+5+6
28´	8+8+8+4	8+6+6+8
29´	8+8+8+5	8+4+5+4+8

ROW LENGTH	STANDARD ROW LENGTH	SYMMETRIC ROW LENGTH (SRL)
30´	8+8+8+6	8+7+7+8
31´	8+8+8+7	8+5+5+5+8
32´	8+8+8+8	8+8+8
33´	8+8+8+5+4	8+6+5+6+8
34´	8+8+8+6+4	8+6+6+6+8
35´	8+8+8+7+4	8+6+7+6+8
36´	8+8+8+8+4	8+8+4+8+8
37´	8+8+8+8+5	8+8+5+8+8
38´	8+8+8+8+6	8+8+6+8+8
39´	8+8+8+8+7	8+8+7+8+8
40´	8+8+8+8+8	8+8+8+8+8
41´	8+8+8+8+5+4	8+6+4+5+4+6+8
42´	8+8+8+8+6+4	8+8+5+5+8+8
43´	8+8+8+8+7+4	8+6+5+5+5+6+8
44´	8+8+8+8+8+4	8+8+6+6+8+8
45´	8+8+8+8+8+5	8+8+4+5+4+8+8
46´	8+8+8+8+8+6	8+8+7+7+8+8
47´	8+8+8+8+8+7	8+8+5+5+5+8+8
48	8+8+8+8+8+8	8+8+8+8+8+8
49´	8+8+8+8+8+5+4	8+8+6+5+6+8+8
50´	8+8+8+8+8+6+4	8+8+6+6+6+8+8

NOTE: SRL will effect pricing – please consult factory.

BionicPro3 | Linear

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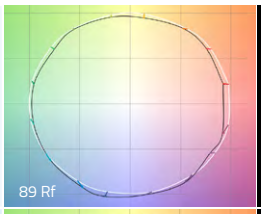
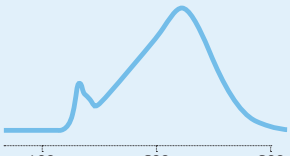
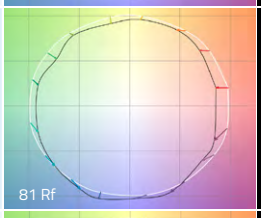
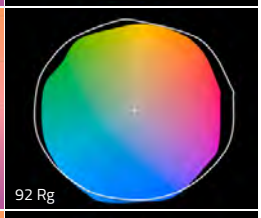
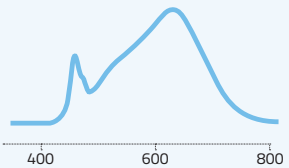
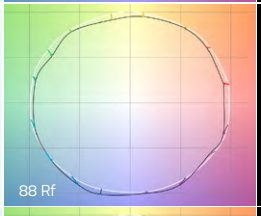
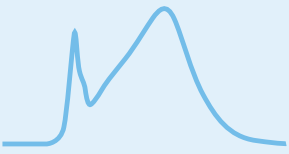
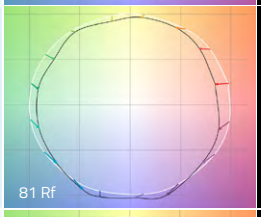
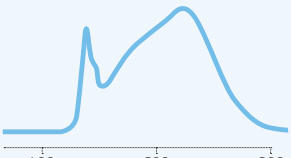
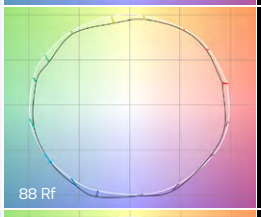
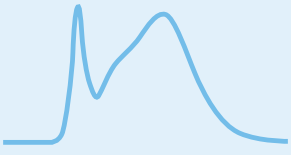
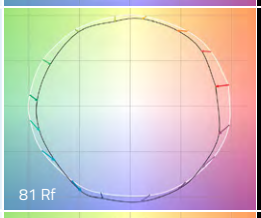
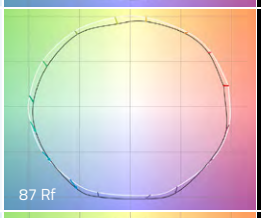
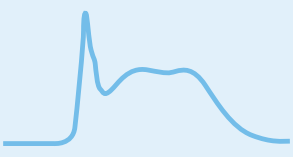
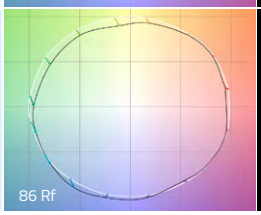
LM79 & TM30 DATA:

	MEASURED CCT	MEASURED LUMENS	CRI	R9	DuV	SPD	TM30 — COLOR VECTOR	TM30 — COLOR DISTORTION
LED27	2680	80%	93	58	0.001			
LED3	3042	95%	82	6	0.001			
LED3-90	3016	85%	93	61	0.000			
LED35	3482	100%	82	3	0.002			
LED35-90	3417	85%	93	67	0.000			
LED4	3952	102%	82	4	0.003			
LED4-90	3882	85%	92	67	0.003			
LED5-90	4889	85%	94	84	0.002			

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SENSORS

					
205: Wattstopper	**ENL:** Enlighted Occupancy / Daylight	**LUX:** Philips LUX Daylight Sensor	**LVOC:** Lutron Occupancy / Daylight Sensor	**LVRF:** Lutron Occupancy / Daylight Sensor	**NXSMP:** Hubbell Occupancy / Daylight Sensor
Low voltage PIR fixture integrated occupancy sensor.	Enlighted Network Integrated/embedded networked lighting control, luminaire-level lighting control, LLLC. When configured as an IoT Node, the sensor streams comprehensive live data for use with Enlighted's real-time location and analytics software applications. This option is available directly from the factory or as a remote upgrade. Wireless Internet.		Lutron VIVE Integrated/ embedded networked lighting control, luminaire-level lighting control, LLLC. Designed to operate as part of a Vive lighting control system. High-end trim, Wireless Internet.	Lutron VIVE Integrated/ embedded networked lighting control, luminaire-level lighting control, LLLC. Designed to operate as part of a Vive lighting control system. High-end trim, Wireless Internet.	Hubbell Integrated/embedded networked lighting control, luminaire-level lighting control, LLLC. PIR motion sensor for automatic On/Off control. Integrated daylight sensor for daylight harvesting and/or lumen maintenance. Bluetooth radio provides wireless control of luminaire. Simple plug-in connection to NX Fixture Modules. Wireless Internet.

SENSOR PLATE

Compton College - VAPA

Received
By PCM3 at 12:54 pm, April 27, 2023

BionicPro3™ | Recessed Linear

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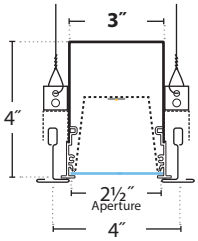
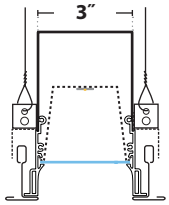
T-BAR — X1, X1M, X1T, X2, X6, X9

FLSH

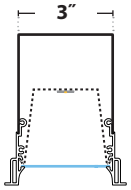


REG1

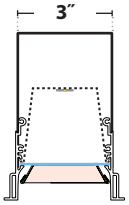


HARD CEILING — X3, X7, X11

REG.5



LVR1



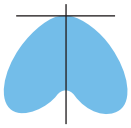
FLSH:

UPTO **121** LPW

(CLICK HERE)

		LO	MO	SO	HO
SAL	Lm/Ft	435	640	885	1115
BTW	Lm/Ft	470	685	950	1200
WWF	Lm/Ft	475	700	975	1225
WWG/PFL	Lm/Ft	475	700	975	1225
MGZ	Lm/Ft	475	700	975	1225
	W/Ft	3.8	5.6	7.8	10.5

LUMEN CHART AT 3500K-80 CRI
SEE PAGES 4-5 FOR REGRESS



BPRO3-REC-FLSH-LED35-MO-BTW

2747	Delivered Lumens
23	Watts
121	lm/w
1.84	Spacing Criteria

SEAMLESS

TechZone4

Declare

DLC

CONSULT FACTORY FOR IC RATED

UGR16 WELL Building Standard

LED WARRANTY 5 YEAR

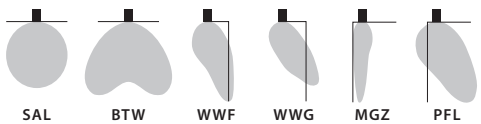
LED Details

Made in the USA

Lumen output may vary +/– 5%
Light Loss Factor (LLF) for CCTs other than 3500K:
4000K +2%, 3000K -5%, 2700K -20%
90 CRI -15% (3K, 3500K, 4K & 5K)
White Louver -30% LLF, Silver -50%, Black -70%

See LED Details PDF for more info

SERIES	LENS POS.	LED COLOR	OUTPUT	NOMINAL LENGTH	TRIM COLOR	DISTRIBUTION	MOUNTING	CIRCUITING	VOLTAGE	CEILING SYSTEMS	DRIVERS	OPTIONS, CONTROL SENSORS & CORNERS
BPro3-REC								SC				
BionicPro3 3″ Slot	**FLSH** Flush Lens **LVR** Louver Flush **REG.5** ½″ Regress **LVR1** Louver ½″ Regress **REG1** 1″ Regress **LVR3*** Louver 2½″ Regress **REG3*** 3″ Regress * NA BTW/WWF/WWG/PFL **NOTE:** Louvers currently NA with corners, consult factory	**LED27** 2700K (90CRI) **LED3** 3000K **LED35** 3500K **LED4** 4000K **LED3-90** 90CRI **LED35-90** 90CRI **LED4-90** 90CRI **LED5-90** 90CRI	**LO** Low **MO** Medium **SO** Standard **HO** High (Non-IC rated, consult factory for EMHE) **PROG** Programmable Light Output (Specify desired lm/ft or w/ft) **NOTE:** Consult factory for **High Output (HO)**	2′ 3′ 4′ 5′ 6′ 7′ 8′ R___ (Row Length, ⅛″ increments) **NOTE:** Individual fixtures are NOT intended for row mounting	**TMW** Textured Matte White (Standard) **YGW** Gloss White **Y__** Premium Color **CC** Custom Color	**SAL** Satin Lens **BTW**** Batwing **WWF**** Flat Wall Wash **WWG**** Focal Glow Wall Wash **MGZ** Medium Wall Graze **PFL**** Perimeter Room Fill ** NA Reg3 / Lvr3	**LP†** Light Pocket **WTW†** Wall to Wall † See page 7 for details	**SC** Single Circuit	**UNV** (120-277) NA with EMHE Emergency 120 277 347 (Emergency battery requires a Step Down transformer and remote box)	**X1** T-Bar 15⁄16″ **X1M** T-Bar 9⁄16″ **X1T** 15⁄16″ T-Bar Tegular **X2** Dimensional T-Bar Armstrong Interlude®, Tegular **X3** Hard Ceiling (Flange Trim) **X6** Slot Grid, Tegular **X7** Mud-Over Flange **X9††** Finished Extruded Side (Grid Ceiling) **X11††** Finished Extruded Side (Ceilings needing nominal lengths) †† See page 6	**ND** Non-Dimming **DM01** 0-10v, 1% Dimming (Standard) **LDE1** Lutron Hi-lume 1% EcoSystem LED (Soft fade on, fade-to-black dimming, non-IC Rated at SO) **ECO** 1% 0-10v, EldoLED (Logarithmic dimming std) **ECDA** 1% DALI, EldoLED (Logarithmic dimming std) **SOLO** 0.1% 0-10v, EldoLED (Dim-to-dark, Logarithmic dimming std) **SODA** 0.1% DALI, EldoLED (Dim-to-dark, Logarithmic dimming std) **STEP** Signify Advance Step Dimming **NOTE:** May require Insulation Detector (ID), see page 9	**EMHE‡** Emergency Battery (1250 Delivered lumens, CA Title 20 compliant) **ETS-DR‡** Iota ETS-DR Emergency Transfer Switch ‡ **2″ + 3″:** Non-IC rated, NA with UNV voltage, Adds 1⅛″ height, see page 9 **IDSM** Insulation Detector Side Mount (for plenums <6″ where fixtures are non-IC rated) **CP** Chicago Plenum **OMB** Overhead Mounting Bracket (X3, X7 and X9 optional installation — 2x per fixture) **SENSORS:** **205** WattStopper PIR **205-ON/OFF** **205-STEP:** Dim to 50% **205-DM:** Dim to 1% **ENL** Enlighted SU-5E-IOT **LUX** Phillips DL **LVOC‡‡** Lutron Vive (Occ & RF) **LVRF‡‡** Lutron Vive (RF Only) **NXSMP** Hubbell (Occ) ‡‡ Requires Lutron driver **CORNERS:** **C2-60** Lit 60° **C2-90** Lit 90° **C2-120** Lit 120° **C2-135** Lit 135° **C3T** Lit 90° 3-Way: **T** **C3Y** Lit 120° 3-Way: **Y** **C4T** Lit 90° 4-Way: **+** **C4X** Lit 45°-135° 4-Way: **X** **C8I** Lit 90° Wall to Ceiling: **INSIDE** **C8O** Lit 90° Wall to Ceiling: **OUTSIDE** **LRT** Linear to Recessed Transition **NOTE:** Corners currently NA with Louvers, consult factory



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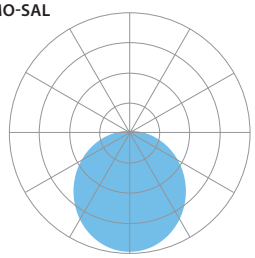
FLSH:

SATIN LENS

MEDIUM OUTPUT:
BPRO3-REC-FLSH-LED35-MO-SAL

2566	Delivered Lumens
23	Watts
113	lm/w
3500	CCT
1.24	Spacing Criteria



Zonal Lumen Summary:
0-90 = 100%

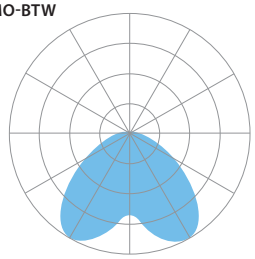
Vertical Angle	0°	25°	45°	65°	90°
0°	940	940	940	940	940
5°	933	934	930	936	938
15°	890	891	890	897	899
25°	808	810	812	823	826
35°	702	704	708	720	724
45°	580	581	585	596	602
55°	448	449	453	460	466
65°	310	311	314	319	325
75°	174	174	177	180	185
85°	45	45	48	50	52
90°	0	0	0	0	0

BATWING

UGR16
WELL Building Standard

MEDIUM OUTPUT:
BPRO3-REC-FLSH-LED35-MO-BTW

2747	Delivered Lumens
23	Watts
121	lm/w
3500	CCT
1.84	Spacing Criteria



Zonal Lumen Summary:
0-90 = 100%

Vertical Angle	0°	25°	45°	65°	90°
0°	690	690	690	690	690
5°	734	727	705	690	684
15°	971	932	819	688	630
25°	1096	1058	910	667	541
35°	1029	1018	903	609	447
45°	796	820	787	512	365
55°	540	566	587	393	295
65°	337	352	371	273	226
75°	178	184	192	162	148
85°	49	50	54	53	53
90°	0	0	0	0	0

LUMEN MAINTENANCE

L70 — 200,000+ Hours
L90 — 100,000+ Hours (LO, MO & SO)
L90 — 60,000+ Hours (HO)

LED SYSTEM LED modules and drivers are field replaceable.

PROG (OPTIONAL) Programmable light output. Specify desired lumens or watts per linear foot.

BINNING Standard binning (all Prudential LED boards) includes testing at the chip level and board integration to provide consistent color temperature within a 3-step MacAdams ellipse, with +/- 5% lumen output range and +/- .004 Duv.

LABELS ETL damp labeled and I.B.E.W. manufactured.
IC-rated except with EMHE emergency or Lutron drivers at SO.

ELECTRICAL Must specify LED dimming controls. LED fixtures have constant current driver(s) with less than 20% THD when loaded to a minimum of 60%. Drivers sink a maximum of 6mA per driver. DM01 LED drivers are 0-10V dimmable and are compatible with most 0-10V wall slide dimmers and direct 0-10V analog signal dimmers. Max driver size 1.65˝ w x 1.25˝ h.

CONSTRUCTION

Housing Extruded aluminum trim and side wall >25% PC recycled, 100% recyclable.

20-gauge steel top housing >20% PC recycled, 100% recyclable.

Lens Seamless lens up to 200'. Consult factory for longer lengths.
Polymer, 100% recyclable.

Weight 4 lbs / ft.

MOUNTING Recessed into drywall or t-bar ceilings.

WARRANTY Single-source, 5 year limited warranty covers standard components and construction.

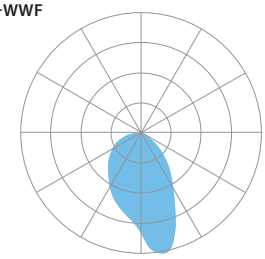
PRUDENTIAL LTG.
PRULITE.COM 213.746.0360

FLSH:

FLAT WALL WASH

STANDARD OUTPUT:
BPRO3-FLSH-LED35-LO-4-WWF

1923 Delivered Lumens
15.40 Watts
125 lm/w
3500 CCT



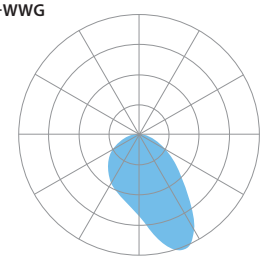
Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	20	20	24	26	26
	75°	69	72	88	92	88
	65°	134	141	178	191	174
	55°	227	244	309	363	323
	45°	371	398	490	613	500
	35°	577	612	748	862	636
	25°	890	936	1056	994	732
	15°	1224	1221	1154	977	797
	5°	994	982	934	883	831
	0°	834	834	834	834	1714
ROOM SIDE	5°	742	747	758	788	831
	15°	649	654	666	705	797
	25°	538	551	580	625	732
	35°	422	432	463	525	636
	45°	329	336	353	399	500
	55°	243	245	250	264	323
	65°	169	165	159	155	174
	75°	97	95	87	81	88
	85°	24	26	24	24	26
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

FOCAL GLOW WALL WASH

LOW OUTPUT:
BPRO3-FLSH-LED35-LO-4-WWG

1901 Delivered Lumens
15 Watts
126 lm/w
3500 CCT



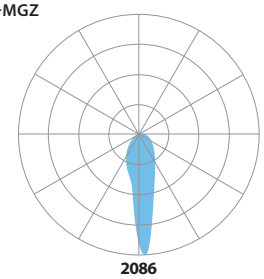
Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	22	22	27	29	30
	75°	75	80	103	104	95
	65°	155	169	226	211	162
	55°	284	312	423	374	249
	45°	494	546	678	555	359
	35°	827	868	885	691	475
	25°	1059	1039	940	767	584
	15°	992	971	893	788	669
	5°	818	815	786	754	715
	0°	720	720	720	720	720
ROOM SIDE	5°	626	635	647	677	715
	15°	523	528	540	582	669
	25°	466	470	474	496	584
	35°	408	409	411	417	475
	45°	351	348	341	335	359
	55°	285	281	263	244	249
	65°	210	203	180	159	162
	75°	121	120	101	90	95
	85°	33	35	30	28	30
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

MEDIUM WALL GRAZER

LOW OUTPUT:
BPRO3-FLSH-LED35-LO-4-MGZ

1930 Delivered Lumens
15 Watts
128 lm/w
4000 CCT



Zonal Lumen Summary:
0-90 = 100%

	Vertical Angle	0°	25°	45°	65°	90°
WALL SIDE	90°	0	0	0	0	0
	85°	24	22	21	23	26
	75°	81	76	75	84	90
	65°	138	133	140	170	183
	55°	200	199	222	304	369
	45°	276	281	320	474	696
	35°	373	384	437	680	1139
	25°	498	515	600	994	1600
	15°	729	765	968	1542	1929
	5°	1756	1771	1925	2097	2076
	0°	2086	2086	2086	2086	2086
ROOM SIDE	5°	1384	1476	1615	1858	2076
	15°	642	677	806	1229	1929
	25°	475	491	550	813	1600
	35°	363	379	418	585	1139
	45°	263	276	315	426	696
	55°	187	194	219	284	369
	65°	132	129	140	165	183
	75°	82	78	75	83	90
	85°	23	25	22	24	26
	90°	0	0	0	0	0
	Vertical Angle	180°	202.5°	225°	247.5°	270°

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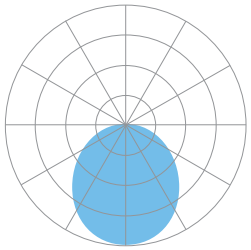
SATIN LENS

REG.5:

STANDARD OUTPUT:
BPRO3-REG.5-LED35-SO-SAL

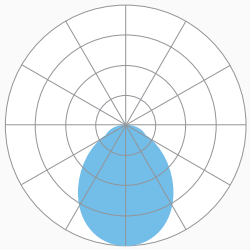
3342	Delivered Lumens
31	Watts
109	Lm/W
3500	CCT



REG1:

STANDARD OUTPUT:
BPRO3-REG1-LED35-SO-4-SAL

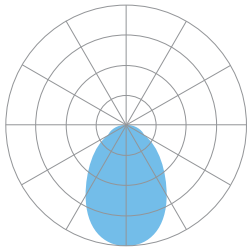
3161	Delivered Lumens
31	Watts
103	Lm/W
3500	CCT



REG3:

STANDARD OUTPUT:
BPRO3-REG3-LED35-SO-4-SAL

2581	Delivered Lumens
31	Watts
83	Lm/W
3500	CCT

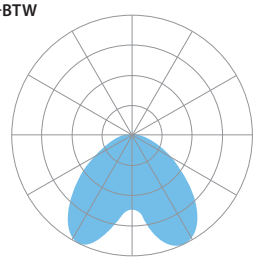


BATWING

REG.5:

STANDARD OUTPUT:
BPRO3-REG.5-LED35-SO-4-BTW

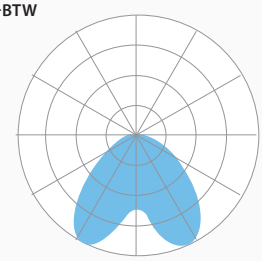
3506	Delivered Lumens
31	Watts
114	Lm/W
3500	CCT



REG1:

STANDARD OUTPUT:
BPRO3-REG1-LED35-SO-4-BTW

3286	Delivered Lumens
31	Watts
107	Lm/W
3500	CCT



REG3:

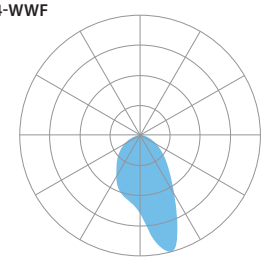
BTW, WWF, WWG/PFL NOT AVAILABLE WITH REG3

FLAT WALL WASH

REG.5:

STANDARD OUTPUT:
BPRO3-REG.5-LED35-SO-4-WWF

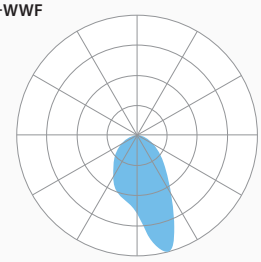
3651	Delivered Lumens
31	Watts
120	Lm/W
3500	CCT



REG1:

STANDARD OUTPUT:
BPRO3-REG1-LED35-SO-4-WWF

3542	Delivered Lumens
31	Watts
115	Lm/W
3500	CCT



REG3:

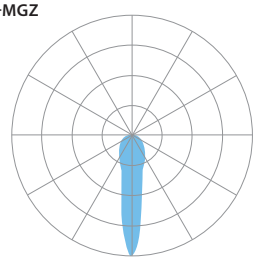
BTW, WWF, WWG/PFL NOT AVAILABLE WITH REG3

MEDIUM WALL GRAZER

REG.5:

STANDARD OUTPUT:
BPRO3-REG.5-LED35-SO-4-MGZ

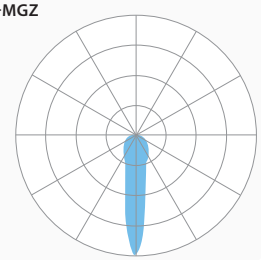
3705	Delivered Lumens
31	Watts
120	Lm/W
3500	CCT
16˚	FWHM



REG1:

STANDARD OUTPUT:
BPRO3-REG1-LED35-SO-4-MGZ

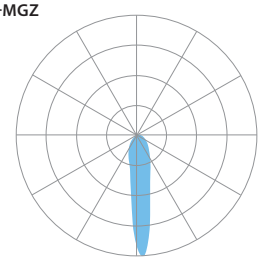
3647	Delivered Lumens
31	Watts
119	Lm/W
3500	CCT
18˚	FWHM



REG3:

STANDARD OUTPUT:
BPRO3-REG3-LED35-SO-4-MGZ

3143	Delivered Lumens
31	Watts
102	Lm/W
3500	CCT
18˚	FWHM



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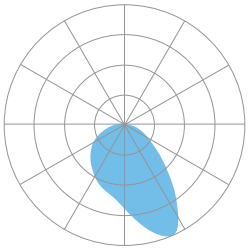
REG.5:

FOCAL GLOW WALL WASH / PERIMETER FILL

STANDARD OUTPUT:
BPRO3-REC-REG.5-LED35-SO-4-PFL

3591 Delivered Lumens
33 Watts
117 Lm/W
3500 CCT



UPTO **120** LPW

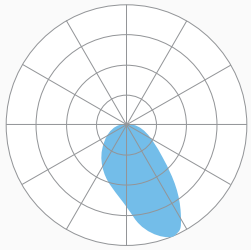
REG.5:		LO	MO	SO	HO
SAL	Lm/Ft	425	625	840	1100
BTW	Lm/Ft	435	640	885	1115
WWF	Lm/Ft	450	670	900	1175
WWG/PFL	Lm/Ft	450	670	900	1175
MGZ	Lm/Ft	460	685	925	1200
	W/Ft	3.8	5.6	7.8	10.5

LUMEN CHART AT 3500K-80 CRI

REG1:

STANDARD OUTPUT:
BPRO3-REC-REG1-LED35-SO-4-PFL

3488 Delivered Lumens
32 Watts
113 Lm/W
3500 CCT



UPTO **119** LPW

REG1:		LO	MO	SO	HO
SAL	Lm/Ft	400	590	800	1040
BTW	Lm/Ft	415	615	840	1075
WWF	Lm/Ft	435	640	885	1115
WWG/PFL	Lm/Ft	435	640	885	1115
MGZ	Lm/Ft	460	685	925	1200
	W/Ft	3.8	5.6	7.8	10.5

LUMEN CHART AT 3500K-80 CRI

REG3:

BTW, WWF, WWG/PFL NOT AVAILABLE WITH REG3

UPTO **102** LPW

REG3:		LO	MO	SO	HO
SAL	Lm/Ft	300	460	650	800
MGZ	Lm/Ft	400	590	800	1040
	W/Ft	3.8	5.6	7.8	10.5

LUMEN CHART AT 3500K-80 CRI

Consult factory for Louver IES: *marketing@prulite.com*

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- **YSW** – Seashell White (Matte)
- **YCH** – Champagne (Metallic)
- **YSL** – Silver (Metallic)
- **YPE** – Pewter (Matte)
- **YRG** – Rain Grey (Gloss)
- **YSTM** – Storm Grey (Matte)
- **YBK** – Black (Matte)
- **YBB** – Black (Semi Gloss)
- **YSKM** – Sky (Matte)
- **YMB** – Military Blue (Matte)
- **YIB** – Interstate Blue (Matte)
- **YSAM** – Sapphire (Matte)
- **YFGM** – Forest Green (Matte)
- **YBR** – Bronze (Matte)
- **YBY** – Boysenberry (Matte)
- **YSRM** – Sunset Red (Matte)
- **YOR** – Orange (Matte)
- **YDAM** – Daffodil (Matte)

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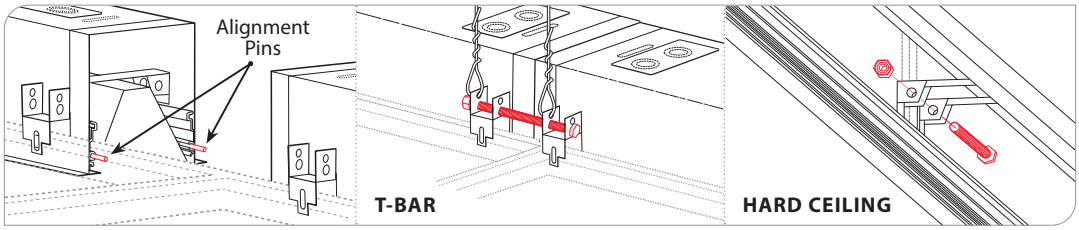
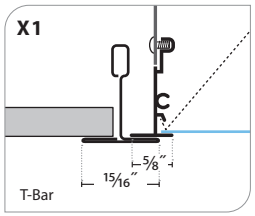
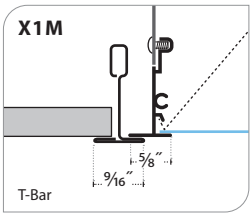
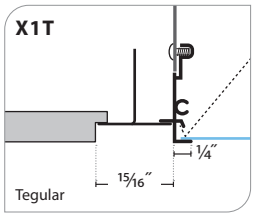
ADJOINING DETAILS

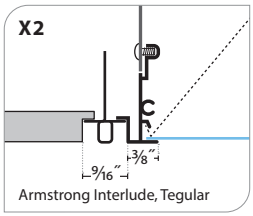


CEILING SYSTEMS

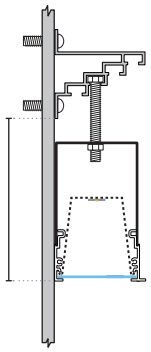


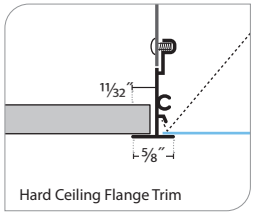


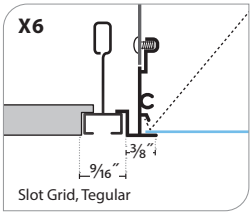


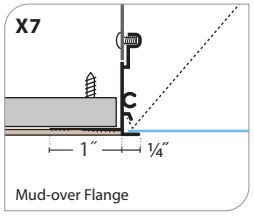


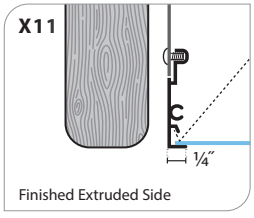
For X11, use the desired height of the bottom face of the fixture as the base measurement point for the wall rail height and screw location.



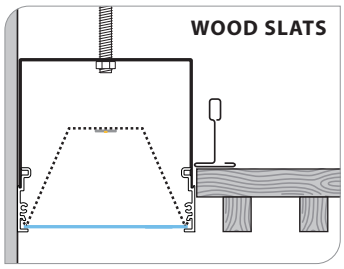


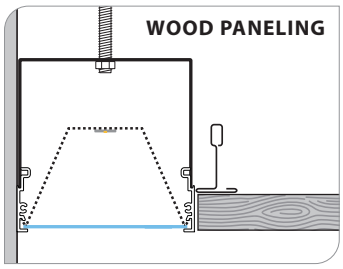


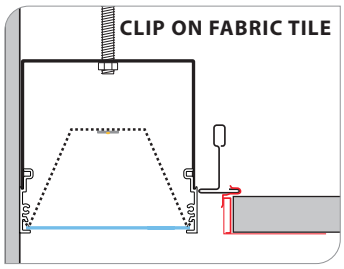




X9







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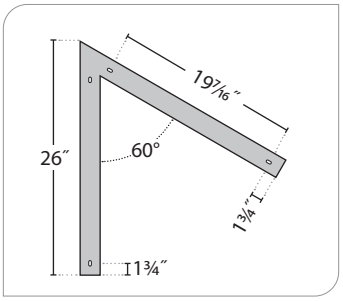
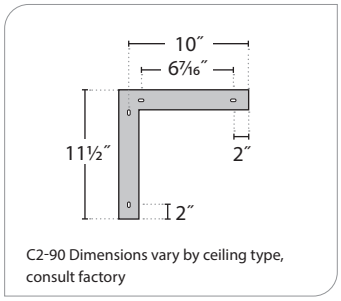
Corners

C2-60:

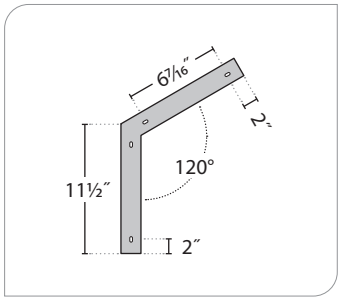


C2-90:

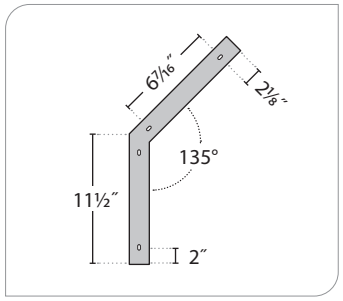


C2-90 Dimensions vary by ceiling type, consult factory

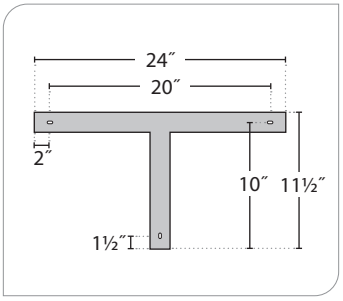
C2-120:



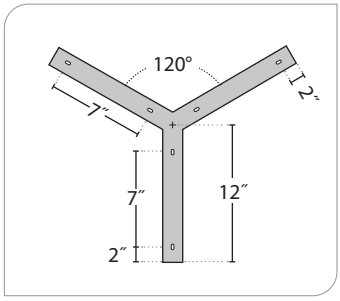
C2-135:



C3T:



C3Y:



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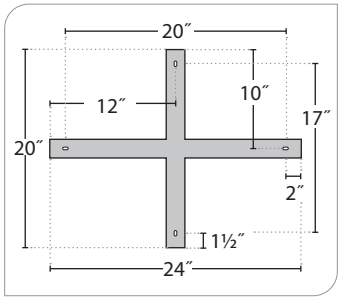
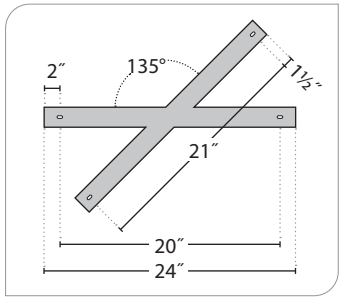


C4X:



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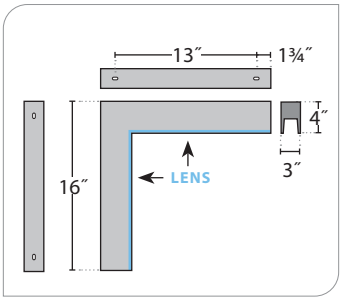

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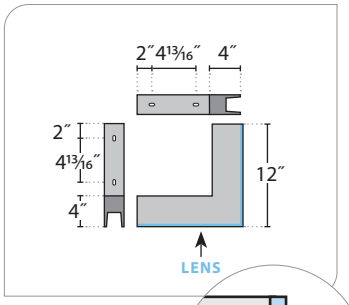
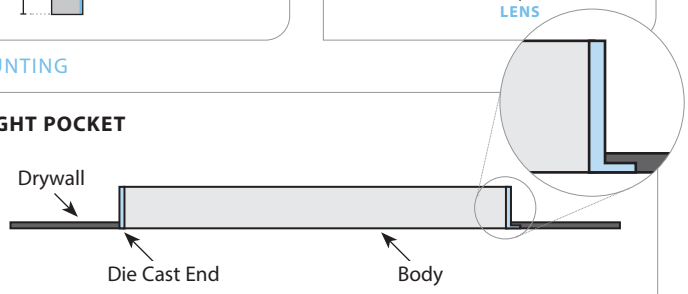
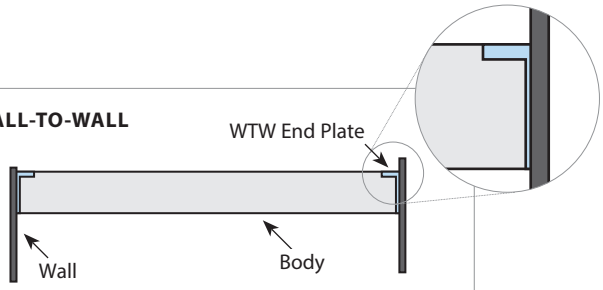


MOUNTING

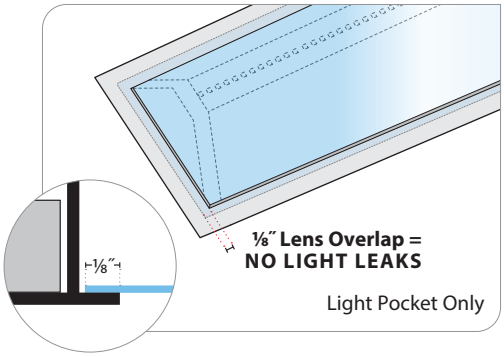
LIGHT POCKET



WALL-TO-WALL

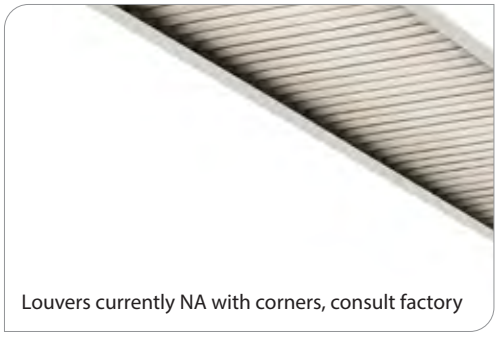


CAST ALUMINUM END CAPS



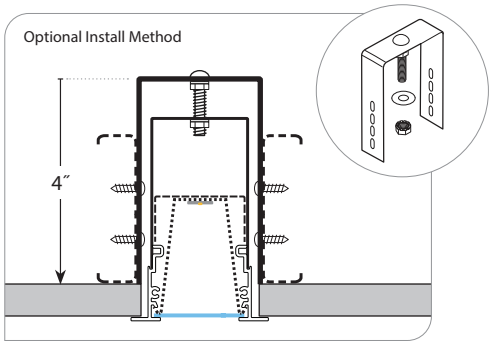
Light Pocket Only

LOUVER DETAIL



Louvers currently NA with corners, consult factory

OVERHEAD MOUNTING BRACKETS (OMB)



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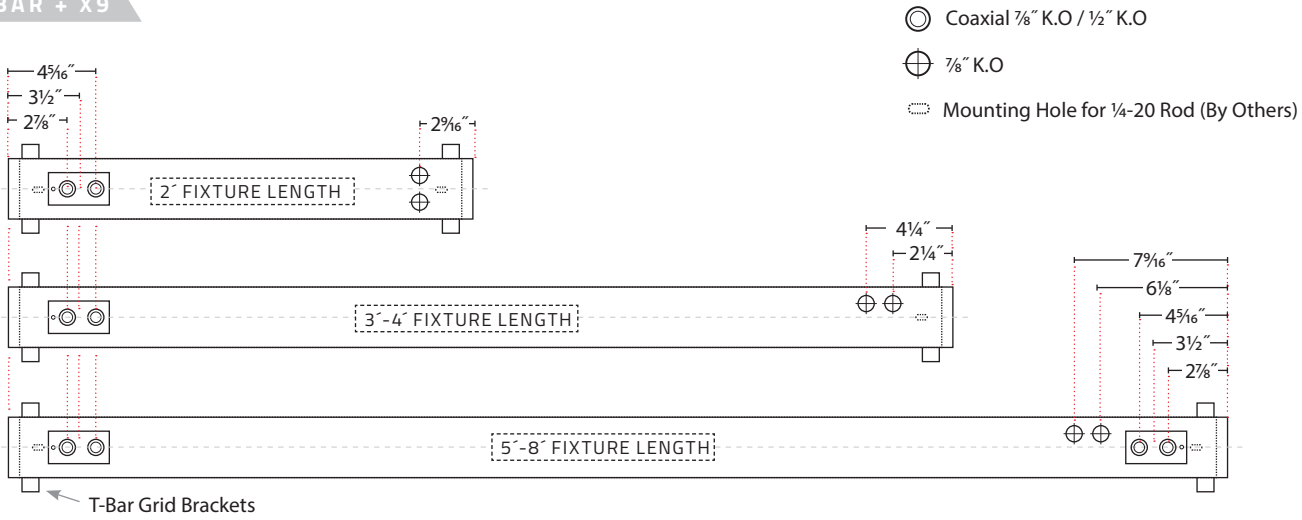
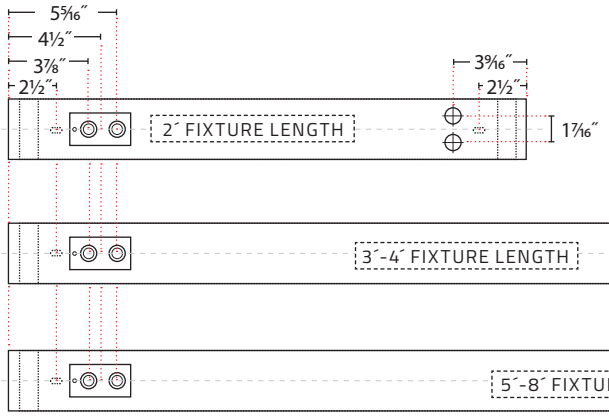
MOUNTING LOCATIONS

T-BAR + X9



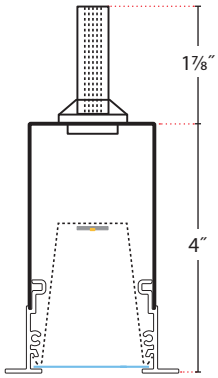
HARD CEILING + X11



ROUGH-IN DIMENSIONS:

LENGTH NOMINAL + 1¼″		WIDTH
2´	25¼″	3¼″
3´	37¼″	
4´	49¼″	
5´	61¼″	
6´	73¼″	
7´	85¼″	
8´	97¼″	

INSULATION DETECTOR (ID)
FOR NON-IC RATED FIXTURES



Insulation Detector (ID) REQUIRED for non IC-rated fixtures
Non IC-rated = **NO INSULATION ALLOWED**

ID REQUIRED for:

Osram	ELDO	Lutron & Signify	EMHE / ETS	Custom Length*	EMHE / ETS + Custom Length
—	**ALL**	—	**SO / HO**	**HO**	**ALWAYS**
			ELDO ALL	**ELDO ALL**	

* Custom length = field adjustable, not 1´ increments

Request **Insulation Detector Side Mount (IDSM)** if plenum less than 6″

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ROW BUILDER

LIGHT POCKET (LP):

ROW LENGTH	FIXTURE ROW
9′	4FT STR + 5FT END
10′	4FT STR + 6FT END
11′	4FT STR + 7FT END
12′	8FT STR + 4FT END
13′	8FT STR + 5FT END
14′	8FT STR + 6FT END
15′	8FT STR + 7FT END
16′	8FT STR + 8FT END
17′	4FT STR + (1) 8FT INT + 5FT END
18′	4FT STR + (1) 8FT INT + 6FT END
19′	4FT STR + (1) 8FT INT + 7FT END
20′	8FT STR + (1) 8FT INT + 4FT END
21′	8FT STR + (1) 8FT INT + 5FT END
22′	8FT STR + (1) 8FT INT + 6FT END
23′	8FT STR + (1) 8FT INT + 7FT END
24′	8FT STR + (1) 8FT INT + 8FT END
25′	4FT STR + (2) 8FT INT + 5FT END
26′	4FT STR + (2) 8FT INT + 6FT END
27′	4FT STR + (2) 8FT INT + 7FT END
28′	8FT STR + (2) 8FT INT + 4FT END
29′	8FT STR + (2) 8FT INT + 5FT END
30′	8FT STR + (2) 8FT INT + 6FT END
31′	8FT STR + (2) 8FT INT + 7FT END
32′	8FT STR + (2) 8FT INT + 8FT END
33′	4FT STR + (3) 8FT INT + 5FT END
34′	4FT STR + (3) 8FT INT + 6FT END
35′	4FT STR + (3) 8FT INT + 7FT END
36′	8FT STR + (3) 8FT INT + 4FT END
37′	8FT STR + (3) 8FT INT + 5FT END
38′	8FT STR + (3) 8FT INT + 6FT END
39′	8FT STR + (3) 8FT INT + 7FT END
40′	8FT STR + (3) 8FT INT + 8FT END
41′	4FT STR + (4) 8FT INT + 5FT END
42′	4FT STR + (4) 8FT INT + 6FT END
43′	4FT STR + (4) 8FT INT + 7FT END
44′	8FT STR + (4) 8FT INT + 4FT END
45′	8FT STR + (4) 8FT INT + 5FT END
46′	8FT STR + (4) 8FT INT + 6FT END
47′	8FT STR + (4) 8FT INT + 7FT END
48	8FT STR + (4) 8FT INT + 8FT END
49′	4FT STR + (5) 8FT INT + 5FT END
50′	4FT STR + (5) 8FT INT + 6FT END

WALL-TO-WALL (WTW):

ROW LENGTH	FIXTURE ROW	MINIMUM FILLER LENGTH	MAXIMUM FILLER LENGTH
9′	4FT STR + 4FT FILLER	8′ - 0″ (96″)	9′ - 2″ (110″)
10′	4FT STR + 5FT FILLER	9′ - 0″ (108″)	10′ - 2″ (122″)
11′	4FT STR + 6FT FILLER	10′ - 0″ (120″)	11′ - 2″ (134″)
12′	4FT STR + 7FT FILLER	11′ - 0″ (132″)	12′ - 2″ (146″)
13′	8FT STR + 4FT FILLER	12′ - 0″ (144″)	13′ - 2″ (158″)
14′	8FT STR + 5FT FILLER	13′ - 0″ (156″)	14′ - 2″ (170″)
15′	8FT STR + 6FT FILLER	14′ - 0″ (168″)	15′ - 2″ (182″)
16′	8FT STR + 7FT FILLER	15′ - 0″ (180″)	16′ - 2″ (194″)
17′	4FT STR + (1) 8FT INT + 4FT FILLER	16′ - 0″ (192″)	17′ - 2″ (206″)
18′	4FT STR + (1) 8FT INT + 5FT FILLER	17′ - 0″ (204″)	18′ - 2″ (218″)
19′	4FT STR + (1) 8FT INT + 6FT FILLER	18′ - 0″ (216″)	19′ - 2″ (230″)
20′	4FT STR + (1) 8FT INT + 7FT FILLER	19′ - 0″ (228″)	20′ - 2″ (242″)
21′	8FT STR + (1) 8FT INT + 4FT FILLER	20′ - 0″ (240″)	21′ - 2″ (254″)
22′	8FT STR + (1) 8FT INT + 5FT FILLER	21′ - 0″ (252″)	22′ - 2″ (266″)
23′	8FT STR + (1) 8FT INT + 6FT FILLER	22′ - 0″ (264″)	23′ - 2″ (278″)
24′	8FT STR + (1) 8FT INT + 7FT FILLER	23′ - 0″ (276″)	24′ - 2″ (290″)
25′	4FT STR + (2) 8FT INT + 4FT FILLER	24′ - 0″ (288″)	25′ - 2″ (302″)
26′	4FT STR + (2) 8FT INT + 5FT FILLER	25′ - 0″ (300″)	26′ - 2″ (314″)
27′	4FT STR + (2) 8FT INT + 6FT FILLER	26′ - 0″ (312″)	27′ - 2″ (326″)
28′	4FT STR + (2) 8FT INT + 7FT FILLER	27′ - 0″ (324″)	28′ - 2″ (338″)
29′	8FT STR + (2) 8FT INT + 4FT FILLER	28′ - 0″ (336″)	29′ - 2″ (350″)
30′	8FT STR + (2) 8FT INT + 5FT FILLER	29′ - 0″ (348″)	30′ - 2″ (362″)
31′	8FT STR + (2) 8FT INT + 6FT FILLER	30′ - 0″ (360″)	31′ - 2″ (374″)
32′	8FT STR + (2) 8FT INT + 7FT FILLER	31′ - 0″ (372″)	32′ - 2″ (386″)
33′	4FT STR + (3) 8FT INT + 4FT FILLER	32′ - 0″ (384″)	33′ - 2″ (398″)
34′	4FT STR + (3) 8FT INT + 5FT FILLER	33′ - 0″ (396″)	34′ - 2″ (410″)
35′	4FT STR + (3) 8FT INT + 6FT FILLER	34′ - 0″ (408″)	35′ - 2″ (422″)
36′	4FT STR + (3) 8FT INT + 7FT FILLER	35′ - 0″ (420″)	36′ - 2″ (434″)
37′	8FT STR + (3) 8FT INT + 4FT FILLER	36′ - 0″ (432″)	37′ - 2″ (446″)
38′	8FT STR + (3) 8FT INT + 5FT FILLER	37′ - 0″ (444″)	38′ - 2″ (458″)
39′	8FT STR + (3) 8FT INT + 6FT FILLER	38′ - 0″ (456″)	39′ - 2″ (470″)
40′	8FT STR + (3) 8FT INT + 7FT FILLER	39′ - 0″ (468″)	40′ - 2″ (482″)
41′	4FT STR + (4) 8FT INT + 4FT FILLER	40′ - 0″ (480″)	41′ - 2″ (494″)
42′	4FT STR + (4) 8FT INT + 5FT FILLER	41′ - 0″ (492″)	42′ - 2″ (506″)
43′	4FT STR + (4) 8FT INT + 6FT FILLER	42′ - 0″ (504″)	43′ - 2″ (518″)
44′	4FT STR + (4) 8FT INT + 7FT FILLER	43′ - 0″ (516″)	44′ - 2″ (530″)
45′	8FT STR + (4) 8FT INT + 4FT FILLER	44′ - 0″ (528″)	45′ - 2″ (542″)
46′	8FT STR + (4) 8FT INT + 5FT FILLER	45′ - 0″ (540″)	46′ - 2″ (554″)
47′	8FT STR + (4) 8FT INT + 6FT FILLER	46′ - 0″ (552″)	47′ - 2″ (566″)
48	8FT STR + (4) 8FT INT + 7FT FILLER	47′ - 0″ (564″)	48′ - 2″ (578″)
49′	4FT STR + (5) 8FT INT + 4FT FILLER	48′ - 0″ (576″)	49′ - 2″ (590″)
50′	4FT STR + (5) 8FT INT + 5FT FILLER	49′ - 0″ (588″)	50′ - 2″ (602″)

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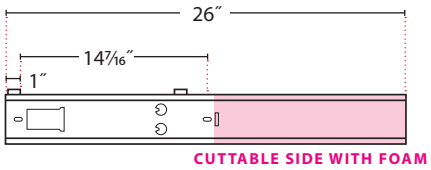
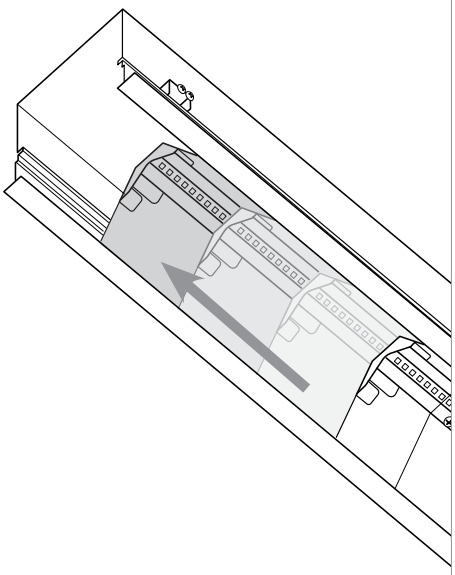
FILLER FIXTURES

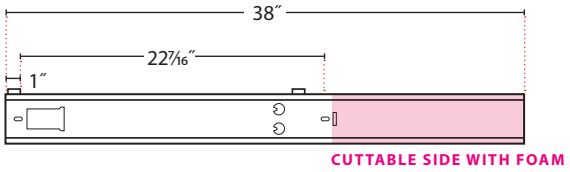
1FR (REMOTE DRIVER):



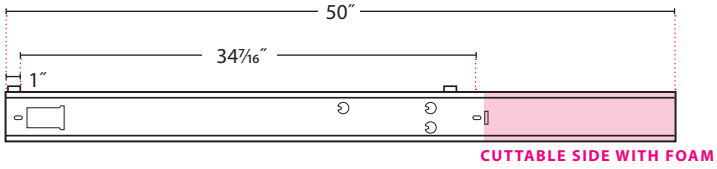
- Telescoping 2′ – 8′ fixtures. Fixtures adjust in length: 2′to 3′, 4′to 5′, 7′to 8′, etc.
- Looks like a custom length fixture:
  7′ 8″ = one field-adjusted fixture, no trim seams (Seamless lens).
- Optical performance identical to standard fixtures.
- Much lower cost for wall-to-wall installs (one less fixture).
- Way easier installs, one cut, no assembly, installs like a standard fixture.



2F:



3F:



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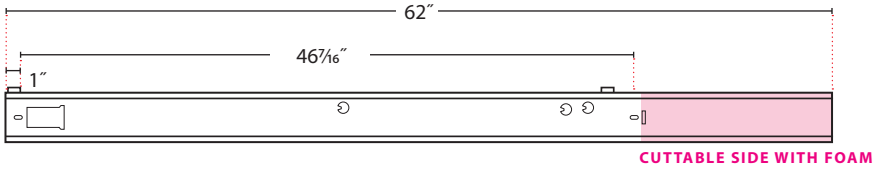

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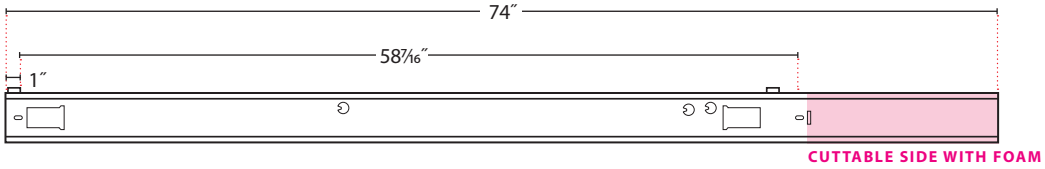

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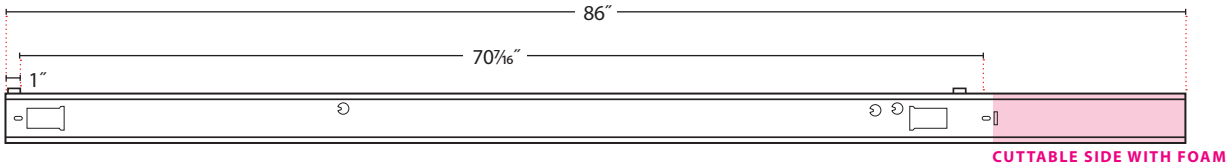
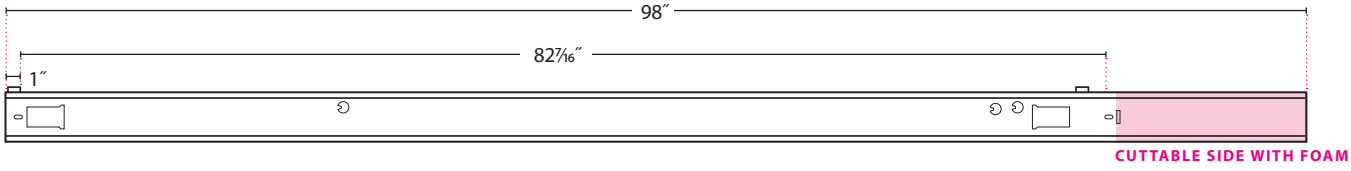


7F:



POWER ACCESS PLATE ¼-20 MOUNTING HOLES

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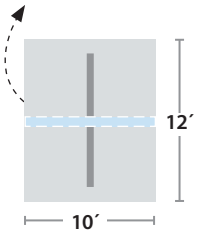
BionicPro3 Batwing Vs. Top 3" Competitor (Satin Lens)

SINGLE OFFICE

BionicPro3

36 43 46 44 39 39 44 47 43 37



Top Competitor

22 28 36 44 52 52 44 36 28 22

	BionicPro3	Competitor
LPW	118	111
SPACING CRITERIA	**1.8**	**1.3**
MAX/MIN	1.8	2.6
W/SQ. FT.	.38	.43
FC AVERAGE	26	30

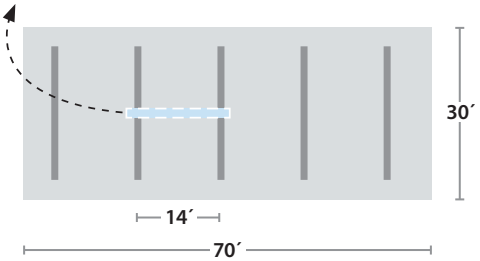
9´ ceiling .85 llf BionicPro3— 5.7w/ft Competitor—6.5w/ft Footcandles at 30˝ working plane

OPEN OFFICE

BionicPro3

39 43 47 47 44 39 36 35 36 40 44 47 47 43 39

14´



Top Competitor

74 68 58 47 38 32 28 27 28 32 38 47 58 68 74

14´

	BionicPro3	Competitor
LPW	118	111
SPACING CRITERIA	**1.85**	**1.3**
MAX/MIN	2.2	4.4
MAX/MIN BETWEEN ROWS	1.3	2.8
W/SQ. FT.	.37	.41
FC AVERAGE	35	37

9´ ceiling .85 llf BionicPro3— 5.7w/ft Competitor—6.5w/ft Footcandles at 30˝ working plane

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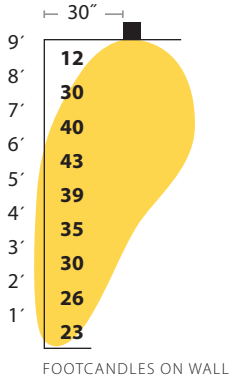
Smooth, flat wall washing (WWF)

Our patent-pending Trubeam™ optics redirect light in an ideal flat wall wash for smooth, even illumantion.

	Watts/Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Medium Output | 700 lumens/ft	6	9′	31 fc	43/12	3.6

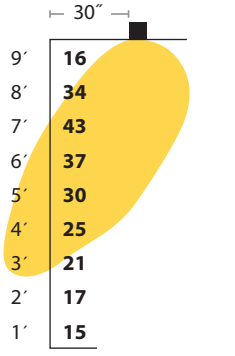


FOOTCANDLES ON WALL

Focal glow wall washing (WWG)

Pique interest by giving works of art 'pop' — more light at eye level

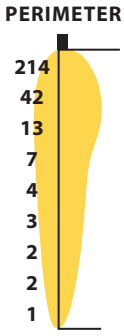
	Watts/Ft.	Ceiling Height	Average Illuminance	Max/Min	Max/Min Ratio
Medium Output | 700 lumens/ft	6	9′	26 fc	43/15	2.9



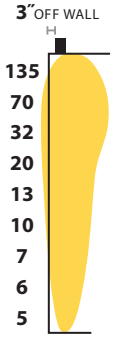
FOOTCANDLES ON WALL

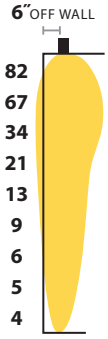
Medium Wall Graze

Wall grazing performance often better just off a wall.



See perimeter specs





BionicPro to Bionic/P23-43 Optics Crossing Matrix

	Satin	Batwing	Flat Wall Wash	Focal Glow Wall Wash
BionicPro	SAL	BTW	WWF	WWG
Bio2 / P23 = BionicPro3	SAL	MBW	MWW/D1W	—
Bionic4 / P43 = BionicPro4	SAL	ABW/D1X	—	AWL/D1W

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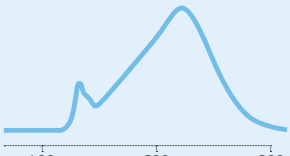
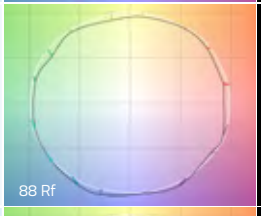
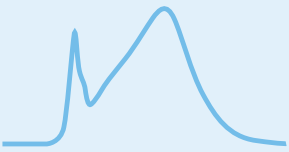
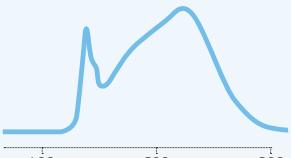
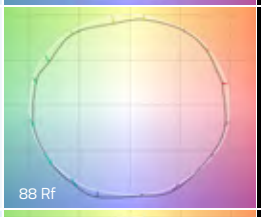
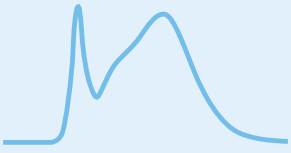
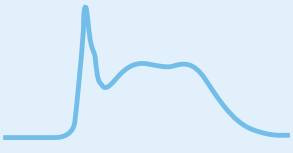
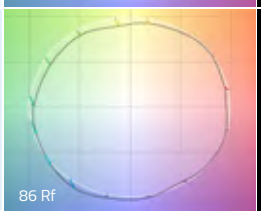
LM79 & TM30 DATA:

	MEASURED CCT	MEASURED LUMENS	CRI	R9	DuV	SPD	TM30 — COLOR VECTOR	TM30 — COLOR DISTORTION
LED27	2680	80%	93	58	0.001			
LED3	3042	95%	82	6	0.001			
LED3-90	3016	85%	93	61	0.000			
LED35	3482	100%	82	3	0.002			
LED35-90	3417	85%	93	67	0.000			
LED4	3952	102%	82	4	0.003			
LED4-90	3882	85%	92	67	0.003			
LED5-90	4889	85%	94	84	0.002			

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PRULITE.COM 213.746.0360

SENSORS

					
205: Wattstopper	**ENL:** Enlighted Occupancy / Daylight	**LUX:** Philips LUX Daylight Sensor	**LVOC:** Lutron Occupancy / Daylight Sensor	**LVRF:** Lutron Occupancy / Daylight Sensor	**NXSMP:** Hubbell Occupancy / Daylight Sensor
Low voltage PIR fixture integrated occupancy sensor.	Enlighted Network Integrated/embedded networked lighting control, luminaire-level lighting control, LLLC. When configured as an IoT Node, the sensor streams comprehensive live data for use with Enlighted's real-time location and analytics software applications. This option is available directly from the factory or as a remote upgrade. Wireless Internet.		Lutron VIVE Integrated/ embedded networked lighting control, luminaire-level lighting control, LLLC. Designed to operate as part of a Vive lighting control system. High-end trim, Wireless Internet.	Lutron VIVE Integrated/ embedded networked lighting control, luminaire-level lighting control, LLLC. Designed to operate as part of a Vive lighting control system. High-end trim, Wireless Internet.	Hubbell Integrated/embedded networked lighting control, luminaire-level lighting control, LLLC. PIR motion sensor for automatic On/Off control. Integrated daylight sensor for daylight harvesting and/or lumen maintenance. Bluetooth radio provides wireless control of luminaire. Simple plug-in connection to NX Fixture Modules. Wireless Internet.

SENSOR PLATE

ADVANCED HIGH CEILING

Signum 10 - Standard

METEOR

10-inch aperture high lumen 10 signum with lumen output 6220 – 9800lm.

Quantity		Type	LT- 12
Project	Compton College - VAPA	Note	

Electrical System

- 8590lm (85W)
  9800lm (110W)
- Power Input: Universal (120-277V)
- Operating Temperature: -13°F~112°F
- Surge Protection: 2.5KV
- Power Factor Greater than 0.9
- Remote Emergency Pack: Bodine BSL20LV

LED Technology

- 2700K, 3000K, 3500K, 4000K, 5000K
- 85 CRI
- Beam Angle: 25°, 40°, 60°, 100°
- Rated Life > 60,000 Hours (L70)

Advanced Dimming

(Proprietary VX Driver is incorporated to all dimming options for video flicker-free lighting)

- Standard 0-10V dims to 10%
- DMX: high resolution dims to 0.1%
  (Supports ANSI E1.20 RDM protocol)
- Superior 0-10V: dims to 1%

85W only:

- LTE: Hi-Lume 1% 2-wire LED Driver (120V forward phase only)

- LDE1: Hi-Lume 1% EcoSystem LED Driver with Soft-on, Fade-to-Black (UNV only)

Housing

- Diameter: 9.84" (250mm)
- Height: 10.83" (275mm)
- Material: Steel, Aluminum
- Weight: 85W / 16.53 lbs, 110W / 17.19 lbs

Mounting

- Surface Mount
- Stem 2ft, 4ft; 37° Swivel Canopy Included
- Adjustable Aircraft Cable 10ft
- Wall Mount
- Yoke Mount

Warranty

- 5-year limited warranty

Listing

- ETL Dry Location Listed
- DLC Listed
- CE

Intertek

ADVANCED HIGH CEILING

Signum 10 - Standard

METEOR

How to Specify:

Ordering Example: SS10-110-358-UNV-SPV-40-BLK-AD10

4-5 weeks lead time on over 75% of specifications.

Model	Wattage	CCT / CRI	Voltage	Dimming
SS10			UNV	
SS10	**85** 85W	278 2700K / CRI85	UNV 120-277V	STV STV Standard 0-10V dims to 10%
Signum 10	**110** 110W	308 3000K / CRI85		SPV Superior 0-10V dims to 1%
		358 3500K / CRI85		**DMX** DMX dims to 0.1% (XLR Sockets)
		408 4000K / CRI85		**DMX(RJ45)** Hi-Lume 1% 2-wire LED Driver
		508 5000K / CRI85		**LTE**[1] (120V forward phase only)
				Hi-Lume 1% EcoSystem LED Driver with
				LDE1[1] Soft-on, Fade-to-Black (UNV only)
				[1]Available for 85W only.

Beam Angle	Finish	Mounting	Accessories
25 25º	BLK Black	SUM Surface Mount	**SPD**[1] Surge Protector
40 40º	WHT White	ST2 Stem 2ft	**EMP** Remote Emergency Pack
60 60º		ST4 Stem 4ft	**CB**[2] Cross Baffle
WD 100º		**AD10** Adjustable Aircraft Cable 10ft	
		WLM Wall Mount	
		YKM Yoke Mount	
			[1]Surge protector for up to 10KV. Applicable for unstable mains or facilities using high power machineries.

DesignLights Consortium™ Qualified Luminaires:

DLC QPL Model Number: SS10-85-358-UNV
Not all product variations listed on this page are DLC qualified.
To ensure that a specific model is qualified, visit www.designlights.org/search.

ADVANCED HIGH CEILING

Signum 10 - Standard

METEOR

Delivered Lumens*

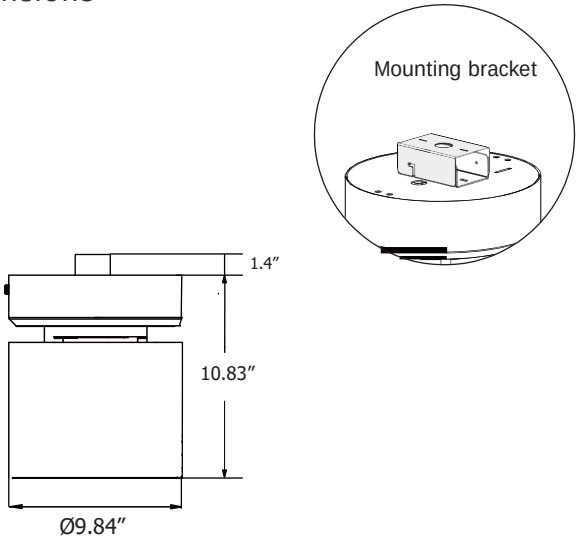
Wattage / CCT	SS10-85	SS10-110
	Beam Angle: 40°	Beam Angle: 60°
5000K	8590 lm	9800 lm
4000K	7600 lm	8890 lm
3500K	7000 lm	8440 lm
3000K	6730 lm	7760 lm
2700K	6220 lm	7430 lm

*Tolerance± 8%

Current Consumption

Volt / Wattage	120V	277V
85W	0.87A	0.38A
110W	1.11A	0.48A

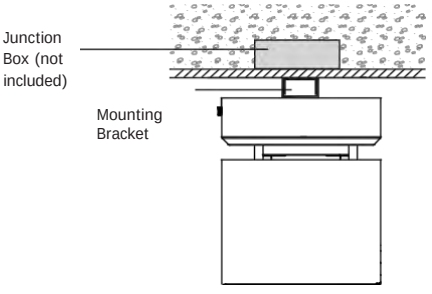
Dimensions



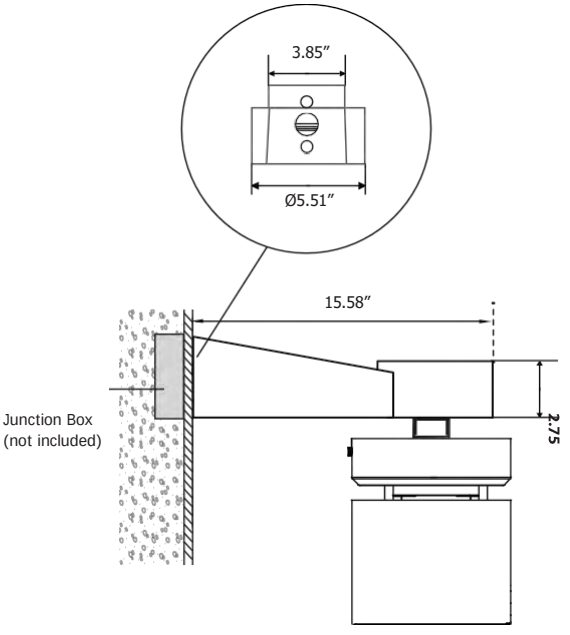
ADVANCED HIGH CEILING

Signum 10 - Standard

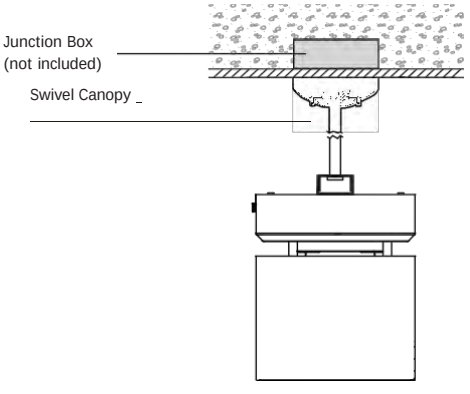
Mounting Options



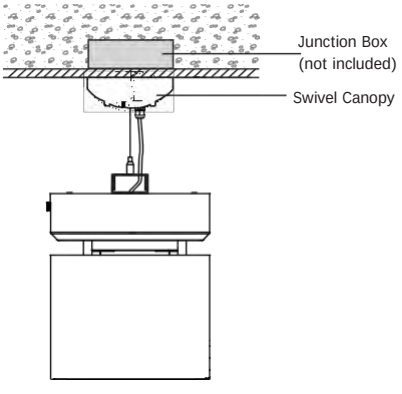
Surface Mount



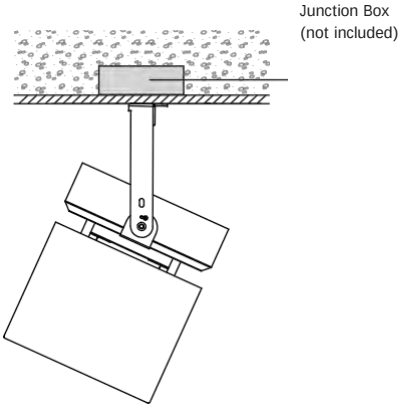
Wall Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

ADVANCED HIGH CEILING

Signum 10 - Standard

DMX Requirements*

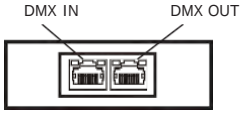
The Signum 10 LED fixture with DMX is a ONE CHANNEL DMX unit.

When placing order, please indicate DMX address. (The DMX address will be listed on the back of the fixture.)

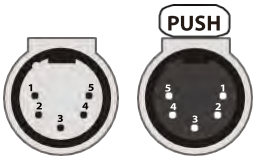
The LED fixture provide RJ45 Socket or XLR socket to connect. (DMX cable NOT included.)

The final fixture should be terminated by the use of DMX Terminator (by others).

RJ45 Sockets



XLR Sockets



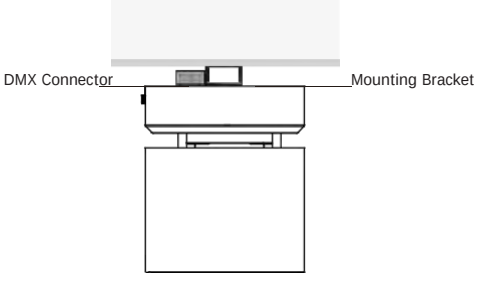
DMX IN DMX OUT

CONNECTION	RJ45 (CAT5e)	5-PIN XLR
Common	WHITE/BROWN(PIN7) & BROWN (PIN 8)	PIN 1
Signal -	ORANGE (PIN 2)	PIN 2
Signal +	WHITE/ORANGE (PIN 1)	PIN 3
Spare	-	PIN 4
Spare	-	PIN 5

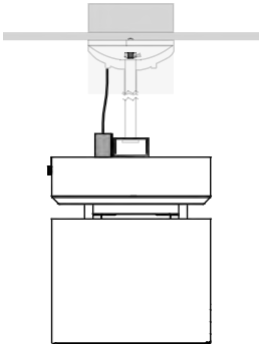
Compatible DMX Cabling List

DMX uses a cable consisting of two twisted pairs plus a shield to carry data. The cable must be specifically impedance matched for the digital DMX signal, meaning that microphone cable or other non-rated cable must not be used to carry DMX. Network cable (Cat5, 5e or 6 cable) may be used to carry DMX in an installation; however special consideration must be given to shielding and termination. Under no circumstances should solid core cable like Cat5 be terminated into a screw down connector.

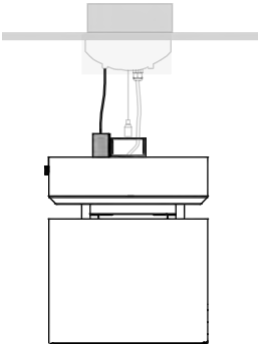
Meteor recommends the use of Belden 9729 for DMX installation. Belden 9729 is a two pair cable, which allows for a spare pair for 'out and back' type terminations if needed. Below is a list of other compatible Belden cables.



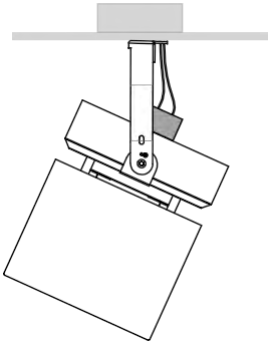
Surface Mount



Stem



Adjustable Aircraft Cable



Yoke Mount

ADVANCED HIGH CEILING

Signum 10 - Standard

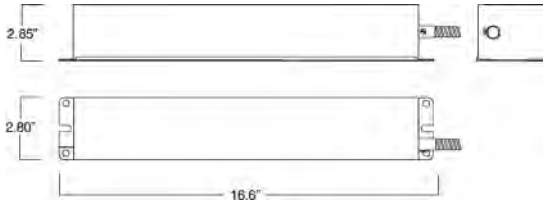
METEOR

Compatible LTE Dimmer List

LUTRON PART NO.

RRD-6NA-	RRT-G5NEW-	RRT-GH	HQRD-10ND-	HQRT-GH	HQRD-HN	PD-10NXD-
RRD-6ND	RRT-G25LW-	HQRD-6NA-	MRF2-6ND-120-	HQRT-G25LW-	GT-250M-	PD-5NE-
RRD-10ND-	RRD-HN	HQRD-6ND-	MRF2S-6ND-120-	HQRT-G5NEW-	GTJ-250M-	

Remote Emergency Pack

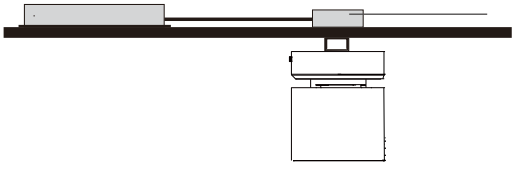


Emergency Pack Lumen Output Table

CCT	2700K	3000K	4000K	5000K
Lumen	1640 lm	1760 lm	1890 lm	1950 lm

Mounting with standard celling recessed Junction BOX

Emergency Battery



Junction box (Not included)

NANOLUME

Micro Profile LED Task and Cove Fixture

Customer: Date: Type:

Project:

- Compact, variable light fixture.
- Fixture comes in 4" increments with a 12" minimum.
- Reflector boosts overall output by 10%. Reflector only available with 120° Optics.
- Boca Flasher's patented CleanDim® technology ensures even dimming from 0-100%.
- Many options in color temperature to suit a range of projects.
- Uses standard line voltage dimming.
- Fixtures are compatible with both forward and reverse phase dimming, can have 0-10V direct dimming or can use Boca's SDS module for 0-10V DALI or DMX Dimming.
- Interior installations only.
- The housing is a high temperature ABS plastic with a durable white or black finish, making it temperature and abrasion resistant.
- Total linear feet per power feed (6W): 120V = 80 ft., 277V = 150 ft.
- Contact Boca Flasher for tips with custom installation procedures.

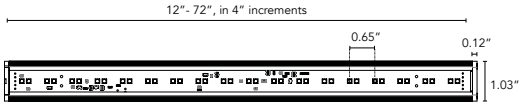
PRODUCT SPECIFICATIONS:

	WATTAGE	COLOR OPTION	VOLTAGE	OPTIC	FINISH	MOUNTING	LENS	BAFFLE	REFLECTOR	DIMMING*
Nanolume										
	3W **6W**	**2000K** **2400K** **2700K** **3000K** **3500K** **4000K**	**120V** **277V**	**10°** **15°x 40°** **120°**	**W** White **B** Black	**S** Swivel **H** Hinge	**C** Clear **CLD** Clear Light Diffused (Not Available with 10° OR 15°X45° Optics) **HD** Heavy Diffused (Not Available with 10° OR 15°X45° Optics)	**SQ** Square **ASYM** Asymmetric	**(Only Available with 120° Optics)** **Y** Yes **N** No	**STANDARD DIMMING** **0-10V DIRECT** 1 Channel **0-10V REMOTE** **DMX REMOTE** **DALI REMOTE**

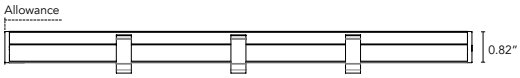
*Additional Charges May Apply

DIMENSIONS:

Plan View

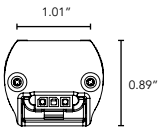


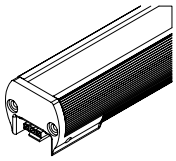
Elevation View



*Third Clip Required for 48" and Larger Fixtures

End View





Boca Flasher, Inc. 508 South Military Trail, Deerfield Beach, Florida 33442 USA Phone: 561.989.5338 Fax: 561.982.8323

NANOLUME

Micro Profile LED Task and Cove Fixture

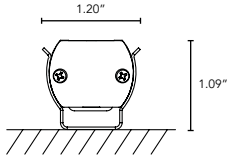
TECHNICAL SPECIFICATIONS:

WATTAGE	3 or 6 watts per linear ft.
INPUT VOLTAGE	90-120V 230-277V
CONTROL	Leading Edge/Trailing Edge line dimmer, 0-10V, DALI, DMX
LED SPACING	5/8" on center
LENGTH	12-72", in 4" increment allow 1/4" for each end cap and 1.25" for power feed cable
TOTAL WIDTH FIXED CLIP	1.20"
TOTAL HEIGHT FIXED CLIP	1.09"
COLOR OPTIONS	2000K, 2400K, 2700K, 3000K, 3500K, 4000K
MOUNTING	Swivel, Hinge
AVAILABLE OPTICS	10°, 15°×40°, 120°
COLOR RENDERING INDEX (CRI)	90 + CRI
RATING	Interior Only IP50
ENVIRONMENTAL	Operating temperature--40°F-140°F Ambient(-40°C-60°C)** Storage temperature -40°F-140°F Ambient indoor fixtures operation limited to =<50% relative humidity

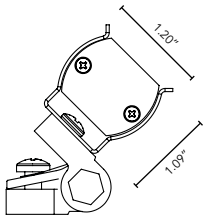
** Military spec available under special request-lead times may be impacted.

MOUNTING INFORMATION:

- For vertical installation please contact the factory for specific mounting instructions.
- For installations above 4' please contact the factory.



Swivel



Hinge

LUMINAIRE INFORMATION:

CCT (K)	Wattage	Lumens	LPW
2000	6	432	72
2400	6	510	85
2700	6	560	94
3000	6	588	98
3500	6	618	103
4000	6	636	106

* Typical delivered lumen data is approximate. Actual lumens will vary due to installation environment and beam pattern. Please see IES files.

Boca Flasher, Inc. 508 South Military Trail, Deerfield Beach, Florida 33442 USA Phone: 561.989.5338 Fax: 561.982.8323

AQUARIUS R Series
LED Mirror/Vanity Light

AQUARIUS Striplight Features
- Surface-mounted striplight ideal for mirror/vanity lighting
- Delta LED lamps (medium base, 120V) included
- Constructed of heavy-gauge extruded aluminum housing and 120V medium base lampholders
- Available in 6" or 12" lamp spacing (Consult factory for custom spacing)
- Wiring and components are concealed inside housing for a sleek, finished look
- Available in a variety of finishes to protect fixture against corrosion
- Custom color-matching powder coat finish also available
- Custom curving to radius available
- Maximum length of single fixture section is 10ft
- Fixtures may ship in sections less than 10ft in order to minimize freight, unless specified otherwise
- Multiple fixture sections can be mounted end-to-end in continuous row
- Fixtures are pre-wired for quick and easy installation
- End caps include 7/8" diameter knockouts; conduit holes may also be opened on sides or bottom of fixture using drill bit
- Lamp guards required per code
- Optional receptacles and switches available
- ETL Listed for Damp location

DELTA Lamp Features

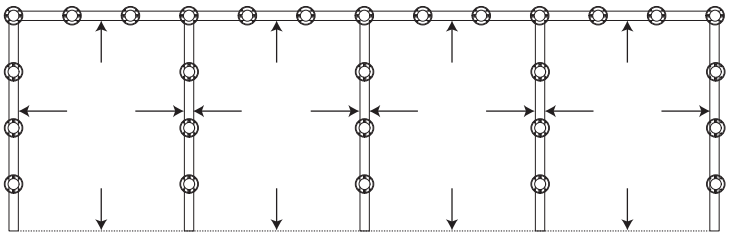
Physical Construction
- Lamp size is comparable to A19 bulb
- Standard E26 medium base
- Frosted exterior

Optical Characteristics
- 2700K frosted lamp emulates standard 60W light bulb (800 lumens)
- Tight color-binning of LEDs ensures uniformity of color
- Emits no UV or IR
- 90 CRI

Electrical Specifications
- Consumes 8.8W per lamp
- Runs on 120V
- UL listed

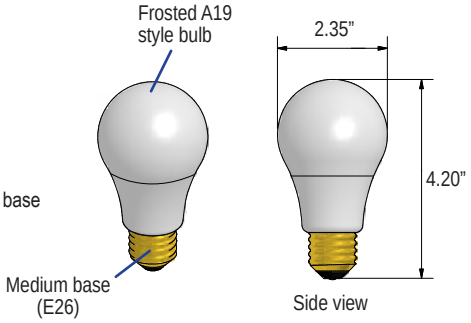
Heat Management and Rated Life
- Built-in heat sink effectively protects LEDs
- Rated life is 25,000 hours, with 70% lumen maintenance, when used in normal environmental conditions
- Long life results in low maintenance and replacement costs
- Produces no radiant heat; optimal for heat-sensitive applications

AQUARIUS R Striplight



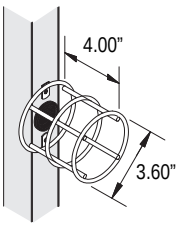
Customer must provide dimensions above
Lamp guards required per code

DELTA LED Lamp
- 2700K frosted lamp
- 800 lumens
- 90 CRI
- 8.8 W per lamp
- 25,000 hours rated life
- 120V
- Retrofits into standard medium base lampholders

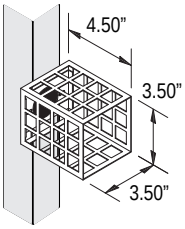


Lamp Guards

Round Lamp Guard
- Welded aluminum
- Standard chrome finish
- (Consult factory for custom finish)
- Screw mounts to fixture

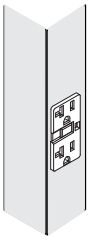


Square Lamp Guard
- Formed aluminum
- Standard satin finish
- (Consult factory for custom finish)
- Screw mounts to fixture

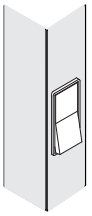


Options

Receptacle
- UL Listed Class A GFCI
- Rated for 20A, 120V
- White color
- Pre-installed into fixture



Switch
- UL Listed
- Rated for 20A, 120V
- White color
- Pre-installed into fixture



How to Specify AQUARIUS R Series

AQR - R -	DF	-		-		-		-	
	DELTA LED Lamp		Lamp Spacing		Finish		Lamp Guard		Options
Example	DF	-	12	-	SAT	-	RLG	-	REC - SWI

DELTA LED Lamp
- DF — 2700K frosted LED lamp (8.8W)

Lamp Spacing
- 6 — 6" on center
- 12 — 12" on center
- Consult factory for custom spacing

Finish
- PAL — Polished Aluminum
- GLD — Polished Gold
- SAT — Anodized satin
- BLK — Powder coat black
- WHT — Powder coat white
- CPC — Custom powder coat (consult factory)

Lamp Guard
- RLG — Round Lamp Guard
- SLG — Square Lamp Guard
- Lamp guards required per code

Options
- RCV — Factory curved to radius (see Radius Guide for details)
- REC — GFCI receptacle
- SWI — Rocker switch

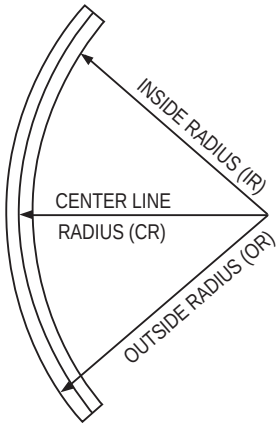
Radius Guide for AQUARIUS R Series

The AQUARIUS R Series fixture can be ordered with custom curves. Complete the form below to specify exact radius information. Consult factory for assistance.

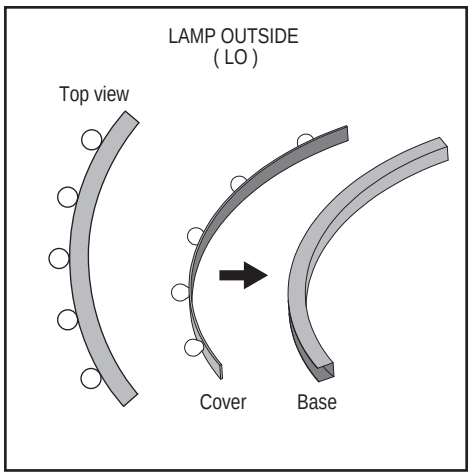
STEP 1 - FILL IN	PRODUCT CODE			Refer to "How to Specify AQUARIUS R Series"
STEP 2 - FILL IN	TOTAL LENGTH OF RUN	FEET:	INCHES:	Measure length of entire run with this radius
STEP 3 - FILL IN	RADIUS	FEET:	INCHES:	Verify in field prior to ordering. Minimum radius is 2 feet.
STEP 4 - CIRCLE ONE	MEASURE POINT (See below for details)	IR CR OR		IR - Inside Radius CR - Centerline Radius OR - Outsdie Radius
STEP 5 - CIRCLE ONE	LAMP POSITION (See below for details)	LO LI LC		LO - Lamp Outside LI - Lamp Inside LC - Lamp Centered

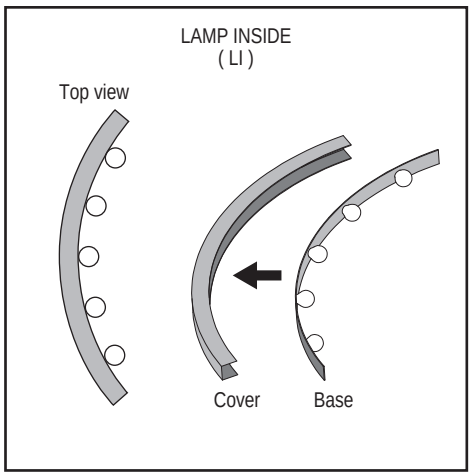
Production will not begin until receipt of above information with appropriate sign-offs. Contractor is responsible for verifying field measurements.
Allow 3 weeks for curving in addition to standard lead times.

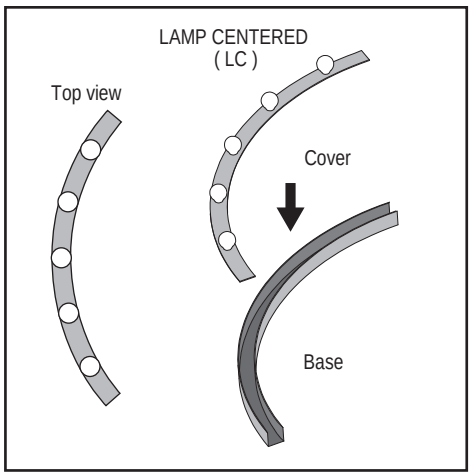
Measure Point



Lamp Position







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Columbia LIGHTING

DATE: | LOCATION:

TYPE: LT- 15 | PROJECT: Compton College - VAPA

CATALOG #:

MPS

MULTIPURPOSE LINEAR

FEATURES

- Uninterrupted ribbon of light; row mounting optional
- Long life 60,000 hour LEDs at L80 for reduced maintenance
- Superior color consistency within a 3-step MacAdam ellipse and greater than 80 CRI
- Available in 2', 4' or 8' lengths
- Optional integral emergency battery pack
- Three lens options as well as less lens (NL)
- Modular replaceable LED boards and driver accessible for future maintenance or upgrades
- Surface mount, wall mount or suspended

Built to UL 924 Standards

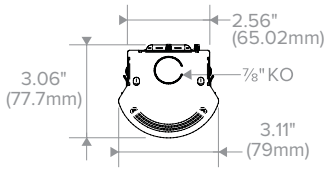
BUY AMERICAN SOLUTIONS

See Certification Specifications

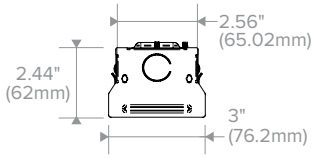
RELATED PRODUCTS

Revalume™ Linear Wrap | Reverie™ Decorative Low Bay

End View—Curve Lens



End View—Flat Lens



CONTROLS TECHNOLOGY

SpectraSync™ Color Tuning Technology | NX DISTRIBUTED™ INTELLIGENCE | SPECTRASAFE™

SPECIFICATIONS

CONSTRUCTION

- Housing, wireway, and ends are formed from code-gauge steel
- Housing components act as heat sink for LED heat dissipation
- White painted parts are treated with a five stage phosphate bonding process and finished with high reflectance baked enamel

OPTICS

- Available with or without frosted acrylic lens

INSTALLATION

- Knockouts are provided for electrical access and mounting

ELECTRICAL

- Long-life LEDs are rated for 60,000 hours at L80 lumen maintenance
- Driver options include fixed output for on/off function, step dimming (high/low/off), or continuous 0–10V dimming
- Superior drivers and long-life LEDs provide quality illumination for prolonged service life
- Drivers < 10% THD at 120V, power factor > 0.95

CONTROLS

- Optional SpectraSync™ offers two modes of Tunable White solutions and integrates seamlessly into a variety of control systems
- NX Distributed Intelligence™ provides options for standalone and networked integrated sensor with wired or wireless connectivity for NX system deployments

TECHNOLOGY

- SpectraSAFE™ is a scalable, cloud-enabled and lighting-based wireless video security solution for interior commercial and industrial applications

CERTIFICATIONS

- IC label is standard for recessed products
- All luminaires are built to UL 1598 and 2108 standards, and bear appropriate cCSAus labels
- Damp Location label standard
- CSA certified to UL 924 standards with battery pack or DTS (Dimming Bypass Module) options

CERTIFICATIONS (CONTINUED)

- Adheres to LM79, LM80, and TM21 industry standards
- The DTS, Dimming Bypass Module, is for emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. See page 10 for wiring diagram. Link to Dimming Bypass Module Specification sheet
- This product qualifies as a "designated country construction material" per FAR 52.225-11 Buy American-Construction Materials under Trade Agreements effective 06/01/2020. See Buy American Solutions

WARRANTY

- 5 year warranty
- See HLI Standard Warranty for additional information

KEY DATA	
Lumen Range	1600–16,732
Wattage Range	13–113
Efficacy Range (LPW)	128–155
Reported Life (Hours)	L80/60,000

HUBBELL Lighting

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Columbia LIGHTING

MPS

MULTIPURPOSE LINEAR

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

ORDERING GUIDE

Example: MPS4–40ML–CW–EDU

CATALOG #

Model	Size [1]		CRI	
MPS MultiPurpose Linear	**2**	2'	**Blank**	>80
	4	4'	**9**	90
	8	8'		

–

Color Temp		Nominal Lumens	
30	3000K	**XW**	4' (2600), 8' (5200)
35	3500K	**VW**	2'(1600), 4'(3300), 8' (6600)
40	4000K	**MW**	2'(2200), 4'(3600), 8' (7200)
50	5000K	**LW**	2'(2400), 4'(4000), 8' (7900)
2750T	2700K–5000K SpectraSync™ Tunable White [2]	**ML**	2'(3400), 4'(4500), 8' (8900)
		HL	2'(3700), 4'(5800), 8' (11,500)
2765T	2700K–6500K SpectraSync™ Tunable White [2]	**VL**	4' (6800), 8' (13,500)
		XL	4' (7,800), 8' (15,500)

–

Lens		Distribution [3]	
C	Curve, Frosted Acrylic	**N**	Narrow Distribution [4]
F	Flat, Frosted Acrylic	**W**	Wide Distribution
NL	Less Lens		
CP	Curve, Frosted Polycarbonate		

–

Driver	
E	Fixed Output
ED	0-10V Dimming
ED1	0-10V 1% Dimming
EDD	0-10V Dim-to-Dark
ESD	Step Dimming
LUTH	Hi-lume 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology [5]
DALIP	DALI Power Bus [6]

Voltage	
U	120V-277V
347	347V (E, ED, ED1 only)

–

Options	
ELL14	Emergency Battery Pack, 10W [7, 8, 9]
ELL14H2	Emergency Battery Pack, 2-Hour Run Time [7, 8, 9, 10]
GLR	Fast Blow Fuse
GTD	Generator Transfer Device [11]
DTS	Dimming Bypass Module [12]
MPSCE	Injection Molded ABS Material Curve Endcap [23]
MPSCE-MB	Injection Molded ABS Material Curve Endcap, Matte Black
MPSFE	Injection Molded ABS Material Flat Endcap [23]
MPSFE-MB	Injection Molded ABS Material Flat Endcap, Matte Black
MB	Matte Black
ZT	ZET Metallic Silver
PAF	Painted After Fabrication
SAF	SpectraSAFE™ Integrated Surveillance Lighting System [13]
MST	MASTER fixture that controls one or more SATELLITE fixtures in a continuous row application [15, 16, 17, 18, 19, 20, 21]
SAT	SATELLITE fixture controlled by MASTER fixture in a continuous row application [16, 17, 18, 19, 20, 21]
INT	Intermediate (provides ends with wiring access for continuous row mounting) [18, 20, 21, 22]
EOR	End of Row (provides end wiring access for continuous row mounting) [18, 20, 21, 22]

–

Control Options [23, 24,25]	
NX / BTSMP Standalone	
NXS	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount [26,27]
BTSL	BTSMP-LMI, PIR BT Occupancy/Daylight [26, 27]
NX Networked – Wired	
NXE	NX, Dual SmartPORTs [14,26,27,28]
NXES	NX, PIR BT Occupancy/Daylight Sensor, Slide Mount, Dual SmartPORTs [14,26, 27,28]
NX Networked – Wireless	
NXSW	NX Wireless, PIR BT Occupancy/Daylight Sensor [14,26,27]
NXWE	NX Wireless Enabled [14,26,27]
Third-Party Control Options	
ODPG	Occupancy and Daylight Sensors w/ Grouping, Philips SNS200 [29,30]
LVR	Lutron Vive Integral Fixture Control DFCSJ-OEM-RF (RF only) [29, 30,31]
LVS	Lutron Vive Integral Fixture Control DFCSJ-OEM-OCC (RF with daylight and occupancy sensing) [29, 30,31]

Accessories

☐ **S18**	18" Stem, Canopy
☐ **SS18**	18" Swivel Stem—45° Swivel
☐ **CM24SCF3-KIT**	24" Adjustable Cable Mounting Kit, 3-wire feed [32]
☐ **CM48SCF3-KIT**	48" Adjustable Cable Mounting Kit, 3-wire feed [32]
☐ **CM24NF-KIT**	Single Point Non-Feed Cable Mount with Canopy, Single - 24" [32]
☐ **CM48NF-KIT**	Single Point Non-Feed Cable Mount with Canopy, Single - 48" [32]
☐ **CSHC**	Chain Hanger Assembly
☐ **MPSZT**	Zip Tee Hanger - 1 ½" Spacer on T-Bar Ceiling
☐ **MPSTH**	Slide Tong Hanger
☐ **MPSCRK-C**	Continuous Row Kit, Curve
☐ **MPSCRK-F**	Continuous Row Kit, Flat
☐ **MPSWG2**	2' Wire Guard
☐ **MPSWG4**	4' Wire Guard, two Required for 8' Fixture
☐ **MPSCE**	Injection Molded ABS Material Curve Endcap
☐ **MPSCE-MB**	Injection Molded ABS Material Curve Endcap, Matte Black
☐ **MPSFE**	Injection Molded ABS Material Flat Endcap
☐ **MPSFE-MB**	Injection Molded ABS Material Flat Endcap, Matte Black

Notes:

1 For continuous row mounting, see Continuous Row Mount Example Guide on page 3
2 See SpectraSync and NX Availability Table on page 6
3 Applicable to lens only
4 Only available with Curve, Frosted Acrylic lens
5 Not available in VL or XL packages
6 DALIP only available when LVS, LVR or ODPG control options are selected
7 Delivered Emergency Lumens = ELL14 = 1210 lms
8 Not available in 2ft size or with thru wire on XL 4ft and 8ft
9 Emergency battery pack max ambient temperature: 25˚C
10 Not available for use in Canada
11 Only available with fixed output driver
12 For emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. Not availble with ESD driver option. Universal voltage only. DTS with 2' cannot be combined with Controls or SpectraSync options. See page 10 for wiring diagram
13 SpectraSync+NX+SAF can not be configured. Only available with NXE or NXWE. Not available in 347V
14 For use with suspended mounting options only. Not available on surface mount options

Continuous-Row Options:

15 MST option not available with INT row position
16 Multiple SAT fixtures can be controlled by one MST fixture. Any one SAT fixture can have no more than one connected MST fixture
17 NX is supported for this application, consult Brand for use with other controls systems
18 Not available with DTS,GTD,ATSD
19 Not available with LUTH
20 All fixtures in a row must be the same driver type and voltage
21 Includes quick-connect wiring harness
22 Suspension support required at every fixture coupling; see Mounting Accessories Guide

NX In-Fixture Control Options:

23 Standard PAF when this option is chosen
24 Control Options include Injection Molded ABS End Cap
25 Fixtures with Control Options are Dry Location rated only
26 Only available with 0–10V dimming drivers (ED, ED1 & EDD)
27 Not available in 2ft when SpectraSync and SpectraSAFE are chosen
28 Not available with surface mounting

Third-Party Control Options:

29 LVS, LVR and ODPG only available with DALIP driver option
30 Not available with SpectraSync (2750T or 2765T)
31 VIVE is a trademark of Lutron Electronics Co., Inc

Accessory Notes:

32 See Columbia Mounting Accessories page for additional options

HUBBELL Lighting

Columbia LIGHTING

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

MPS

MULTIPURPOSE LINEAR

ORDERING GUIDE (CONTINUED)

CONTINUOUS ROW MOUNT EXAMPLE GUIDE					
Continuous Row Length	MPS4	MPS8	MPSCRK-*	CM**SCF*-KIT	CM**NF-KIT
12' — Option 1	1	1	1	1	1
12' — Option 2	3	0	2	1	1
16' — Option 1	0	2	1	1	1
16' — Option 2	2	1	2	1	2
32' — Option 1	0	4	3	2	1
32' — Option 2	2	3	4	2	1

Link to Columbia Mounting Accessories page

PRODUCT EXCEPTIONS & DETAILS

Driver options listed below are available for the outputs as shown.

DRIVER AVAILABILITY TABLE — 2'					
	VW	MW	LW	ML	HL
E	x	x	x	x	x
ED	x	x	x	x	x
ED1	x	x	x	x	x
EDD	x	x	x	x	x
ESD	x	x	x	x	x
LUTH	x	x	x	x	x
347	x	x	x	x	x
DALIP	x	x	x	x	x

DRIVER AVAILABILITY TABLE — 4' & 8'								
	XW	VW	MW	LW	ML	HL	VL	XL
E	x	x	x	x	x	x	x	x
ED	x	x	x	x	x	x	x	x
ED1	x	x	x	x	x	x	x	x
EDD	x	x	x	x	x	x	x	x
ESD	x	x	x	x	x	x	x	x
347	x	x	x	x	x	x	x	x
LUTH	x	x	x	x	x	x		
DALIP	x	x	x	x	x	x	x	x

TEMPERATURE TABLE (C°) — 4' & 8'											
		80 CRI									
		E/ED/ED1		ESDU		ED347		EDD		LUT	
Size	Lumen Package	Ceiling/ Surface Mount	Pendant/ TH Mount	Ceiling/ Surface Mount	Pendant/ TH Mount	Ceiling/ Surface Mount	Pendant/ TH Mount	Ceiling/ Surface Mount	Pendant/ TH Mount	Ceiling/ Surface Mount	Pendant/ TH Mount
2'	VW	35	40	35	40	35	40	35	40	35	40
	MW	35	40	35	40	35	40	35	40	35	40
	LW	35	40	35	40	35	40	35	40	35	40
	ML	35	40	35	40	35	40	35	40	35	40
	HL	30	35	30	35	30	35	30	35	30	35
	XW	35	45	35	45	35	45	30	35	30	35
4'	VW	35	45	35	45	35	45	30	35	30	35
	MW	35	45	35	45	35	45	30	35	30	35
	LW	35	45	35	45	35	45	30	35	30	35
	ML	35	45	35	45	35	45	30	35	30	35
	HL	35	40	35	40	35	40	25	30	30	35
	VL	30	30	30	30	30	30	30	30	—	—
	XL*	25	25	25	25	25	25	25	25	—	—
8'	XW	35	45	35	45	35	45	30	35	30	35
	VW	35	45	35	45	35	45	30	35	30	35
	MW	35	45	35	45	35	45	30	35	30	35
	LW	35	45	35	45	35	45	30	35	30	35
	ML	35	45	35	45	35	45	30	35	30	35
	VL	30	30	30	30	30	30	30	30	—	—
	XL*	25	25	25	25	25	25	25	25	—	—

*XL not available with thru wire

HUBBELL Lighting

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Columbia LIGHTING

MPS

MULTIPURPOSE LINEAR

CONTROLS

NX Distributed Intelligence™ Lighting Controls:

Supports both indoor and outdoor applications in a variety of deployment options- wired, wireless, hybrid.
Integrates with and enables a wide array of luminaires including those with SpectraSync™ Color Tuning Technology.

NX DISTRIBUTED™ INTELLIGENCE

NX INTEGRATED CONTROLS REFERENCE								
NX Option	Sensor	Networkable	Scheduling	Occupancy	Daylight Harvesting	0–10V Dimming	On/off Control	Bluetooth® App Programming
NX Standalone								
NXS	NXSMP-SMI	No	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wired								
NXE	N/A	Yes	Yes	No	No	Yes	Yes	Requires NXBTC/R[1]
NXES	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NX Networked – Wireless								
NXSW	NXSMP-SMI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NXWE	N/A	Yes	Yes	No	No	Yes	Yes	No[2]

1 NXBTC/R needs to be plugged into an available NX SmartPORT™ on the fixture network
2 To program NXWE option, need to consult factory. If connected to an area controller, programming can be done from that

Philips EasySense Controls ODPG Sensor:

- Occupancy sensing, daylight harvesting, task tuning and grouping in one device
- Standalone control or grouping to wireless switches[1]
- Uses Philips field apps for on site commissioning[2,3]
- Ability to create scenes for various room configurations
- Cost-effective solution for energy-savings and code-compliancy strategies
- DLC® Qualified: Listed on the QPL for Networked Lighting Controls. Please refer to the DLC website for specific product qualifications at www.designlights.org

1 Wireless switches only compatible with ODPG Philips EasySense
2 See link to Philips commssioning
3 Requires android device or IR dongle. See links for phone compatiblity and IR dongle

Wireless Switch Accessories[1]

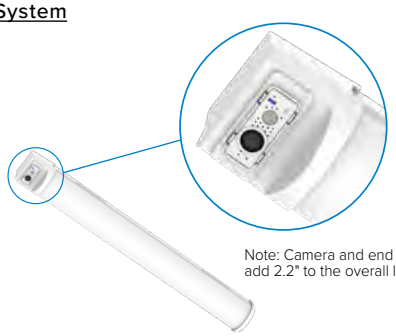
☐	PESR-WH	EasySense compatible wireless single rocker switch, white
☐	PEDR-WH	EasySense compatible wireless dual rocker switch, white

SPECTRASAFE

SpectraSAFE™ Integrated Surveillance Lighting System

Technical Features

- High resolution 1080p full HD camera
- 2.8mm lens / 140° field of view
- IR emitter for low / no-light conditions
- Multiple wiring configurations available
- Supports 2-way audio communication
- Supports 2.4GHz WPA-PSK/WPA2-PSK Wi-Fi
- Data encrypted using AES 256 standard
- Low power consumption (2-5W)
- Transmissions secured using Open TLS / SSL



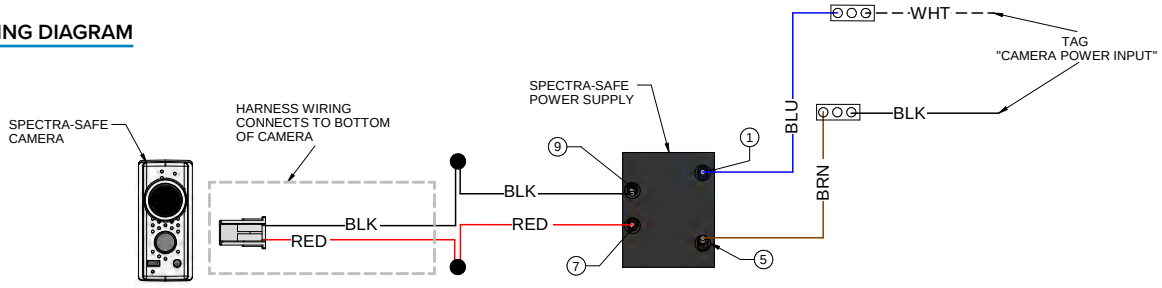
Note: Camera and end cap add 2.2" to the overall length.

Software & Support

- Free Android, iOS and web-based app
- Versatile and supports multiple applications
- Multi-tenant web-based camera application
- Phone and in-app chat technical support
- Scalable cloud services and video storage
- Supported by a 5-year warranty

SPECTRASAFE WIRING DIAGRAM

Power Supply	
Pin Connections	
Pin#	Single
1	VAC in (N)
5	VAC in (L)
7	+Vout
9	-Vout



NX Design & Application Guide
NX Brochure
Philips SNS200
ES Design-in Guide
SpectraSAFE Brochure

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MPS

MULTIPURPOSE LINEAR

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

CONTROLS (CONTINUED)

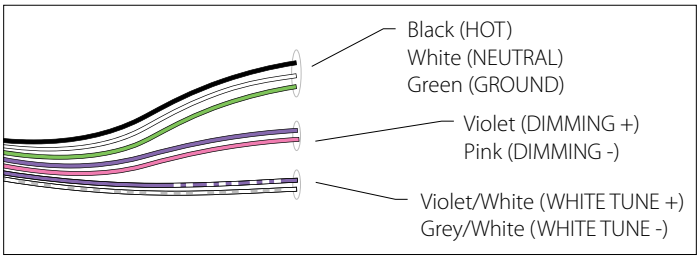
SpectraSync™ Color Tuning Technology:

Control your space based on the needs of the application, specific activities throughout the day and preferences of the occupants with distinct SpectraSync™ Color Tuning Technologies.

SPECTRASYNC COLOR TUNING TECHNOLOGY		
Mode	Kelvin Range	Description
Tunable White	2700K–5000K 2700K–6500K	Offers users the ability to tailor CCT to their personal preference, enhancing task visibility, material and colors or the aesthetics of the space

SpectraSync Tunable White

Available in two options: 2750T (2700K–5000K) or 2765T (2700K–6500K). Requires two 0–10V controllers, one for intensity and one for CCT. Minimum 5% dimming.

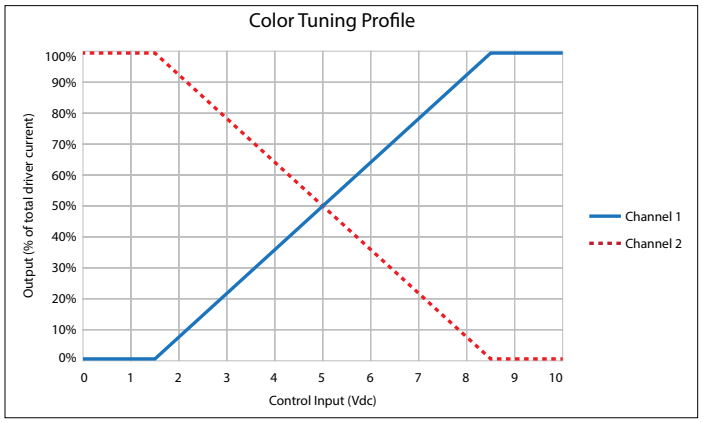


SpectraSync Tunable White luminaires are provided with two 0–10V circuits. The violet and pink circuit is for wiring to any qualified 0–10V controller for dimming. The violet/white and grey/white circuit is for wiring to any qualified 0–10V controller for Tunable White CCT control.

Controller Manufacturer Data

SpectraSync Tunable White was designed to be used with sinking style dimmers (provided by others) and is compatible with:

- Hubbell Control Solutions (HCS): NX Distributed Intelligence™ Room Controllers (NXRC) and In-fixture Controllers (NXFM)
- Lutron: DVTV, DVSTV, and NFTV dimmers
- Wattstopper: ADF120277 and CD4BL (Titan) dimmers



To enable scheduling and for use with NX wall control preset stations please refer to Hubbell Control Solutions NX SpectraSync technical sheet.

SPECTRASYNC™ AND NX AVAILABILITY TABLE

		Only With 80 CRI No Battery Pack			Only With 80 CRI With Battery Pack		
Size	Lumen package	CTC	NX	CTC+NX	CTC	NX	CTC+NX
2ft	VW	Y	Y	N	—	—	—
	MW	Y	Y	N	—	—	—
	LW	Y	Y	N	—	—	—
	ML	N	Y	N	—	—	—
	HL	N	Y	N	—	—	—
4ft	XW	Y	Y	Y	Y	Y	Y
	VW	Y	Y	Y	Y	Y	Y
	MW	Y	Y	Y	Y	Y	Y
	LW	Y	Y	Y	Y	Y	Y
	ML	Y	Y	Y	Y	Y	Y
	HL	Y	Y	Y	Y	Y	Y
	VL	N	Y	N	N	Y	N
	XL	N	Y	N	N	Y	N
8ft	XW	Y	Y	Y	Y	Y	Y
	VW	Y	Y	Y	Y	Y	Y
	MW	N	Y	N	N	Y	N
	LW	N	Y	N	N	Y	N
	ML	N	Y	N	N	Y	N
	HL	N	Y	N	N	Y	N
	VL	N	Y	N	N	Y	N
	XL	N	Y	N	N	Y	N

HUBBELL Lighting

Columbia LIGHTING

MPS

MULTIPURPOSE LINEAR

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

DELIVERED LUMENS

STANDARD EFFICACY PERFORMANCE TABLE						
FIXTURE	COLOR	LENS	DISTRIBUTION	LUMENS	INPUT WATTS	LPW
MPS4-XW	3500K	CURVE	WIDE	2,544	18.1	141
		CURVE	NARROW	2,490	18.1	138
		FLAT	WIDE	2,460	18.1	136
		No Lens		2,719	18.1	150
	4000K	CURVE	WIDE	2,573	18.1	142
		CURVE	NARROW	2,518	18.1	139
		FLAT	WIDE	2,488	18.1	137
		No Lens		2,750	18.1	152
MPS4-VW	3500K	CURVE	WIDE	3,223	23.6	137
		CURVE	NARROW	3,221	23.6	137
		FLAT	WIDE	3,073	23.5	131
		No Lens		3,454	23.6	146
	4000K	CURVE	WIDE	3,258	23.6	138
		CURVE	NARROW	3,256	23.6	138
		FLAT	WIDE	3,107	23.5	132
		No Lens		3,492	23.6	148
MPS4-MW	3500K	CURVE	WIDE	3,541	26.7	133
		CURVE	NARROW	3,504	26.7	131
		FLAT	WIDE	3,453	26.8	128
		No Lens		3,811	26.7	143
	4000K	CURVE	WIDE	3,580	26.7	134
		CURVE	NARROW	3,543	26.7	133
		FLAT	WIDE	3,491	26.8	130
		No Lens		3,853	26.7	144
MPS4-LW	3500K	CURVE	WIDE	3,878	27.3	142
		CURVE	NARROW	3,836	27.4	140
		FLAT	WIDE	3,753	27.4	137
		No Lens		4,172	27.4	152
	4000K	CURVE	WIDE	3,921	27.3	144
		CURVE	NARROW	3,878	27.4	142
		FLAT	WIDE	3,794	27.4	138
		No Lens		4,218	27.4	154
MPS4-ML	3500K	CURVE	WIDE	4,419	31.6	140
		CURVE	NARROW	4,370	31.6	138
		FLAT	WIDE	4,230	31.6	134
		No Lens		4,784	31.7	151
	4000K	CURVE	WIDE	4,468	31.6	141
		CURVE	NARROW	4,418	31.6	140
		FLAT	WIDE	4,277	31.6	135
		No Lens		4,837	31.7	153
MPS4-HL	3500K	CURVE	WIDE	5,658	41.7	136
		CURVE	NARROW	5,592	41.7	134
		FLAT	WIDE	5,393	41.5	130
		No Lens		5,489	41.8	131
	4000K	CURVE	WIDE	5,720	41.7	137
		CURVE	NARROW	5,654	41.7	136
		FLAT	WIDE	5,452	41.5	131
		No Lens		5,549	41.8	133
MPS4-VL	3500K	CURVE	WIDE	6,643	47.1	141
		CURVE	NARROW	6,571	47.1	140
		FLAT	WIDE	4,983	36.3	137
		No Lens		7,217	47.2	153
	4000K	CURVE	WIDE	6,717	47.1	143
		CURVE	NARROW	6,644	47.1	141
		FLAT	WIDE	5,038	36.3	139
		No Lens		7,297	47.2	155
MPS4-XL	3500K	CURVE	WIDE	7,646	56.4	136
		CURVE	NARROW	7,522	56.4	133
		FLAT	WIDE	7,325	56.6	129
		No Lens		8,273	56.6	146
	4000K	CURVE	WIDE	7,732	56.4	128
		CURVE	NARROW	7,608	56.4	135
		FLAT	WIDE	7,408	56.6	131
		No Lens		8,366	56.6	148
MPS8-XW	3500K	CURVE	WIDE	5,089	36.2	141
		CURVE	NARROW	4,980	36.2	138
		FLAT	WIDE	4,921	36.2	136
		No Lens		5,439	36.2	150
	4000K	CURVE	WIDE	5,146	36.2	142
		CURVE	NARROW	5,037	36.2	139
		FLAT	WIDE	4,977	36.2	137
		No Lens		5,500	36.2	152

HUBBELL Lighting

Columbia LIGHTING

MPS

MULTIPURPOSE LINEAR

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

STANDARD EFFICACY PERFORMANCE TABLE						
FIXTURE	COLOR	LENS	DISTRIBUTION	LUMENS	INPUT WATTS	LPW
MPS8-VW	3500K	CURVE	WIDE	6,446	47.2	137
		CURVE	NARROW	6,442	47.2	136
		FLAT	WIDE	6,146	47	131
		No Lens		6,908	47.2	146
	4000K	CURVE	WIDE	6,517	47.2	138
		CURVE	NARROW	6,513	47.2	138
		FLAT	WIDE	6,214	47	132
		No Lens		6,984	47.2	148
MPS8-MW	3500K	CURVE	WIDE	7,082	53.4	133
		CURVE	NARROW	7,008	53.4	131
		FLAT	WIDE	6,906	53.6	129
		No Lens		7,622	53.4	143
	4000K	CURVE	WIDE	7,160	53.4	134
		CURVE	NARROW	7,085	53.4	133
		FLAT	WIDE	6,982	53.6	130
		No Lens		7,706	53.4	144
MPS8-LW	3500K	CURVE	WIDE	7,756	54.6	142
		CURVE	NARROW	7,672	54.8	140
		FLAT	WIDE	7,506	54.8	137
		No Lens		8,344	54.8	152
	4000K	CURVE	WIDE	7,841	54.6	144
		CURVE	NARROW	7,756	54.8	142
		FLAT	WIDE	7,589	54.8	138
		No Lens		8,436	54.8	154
MPS8-ML	3500K	CURVE	WIDE	8,838	63.2	140
		CURVE	NARROW	8,740	63.2	138
		FLAT	WIDE	8,460	63.2	134
		No Lens		9,568	63.4	151
	4000K	CURVE	WIDE	8,935	63.2	141
		CURVE	NARROW	8,836	63.2	140
		FLAT	WIDE	8,553	63.2	135
		No Lens		9,673	63.4	153
MPS8-HL	3500K	CURVE	WIDE	11,316	83.4	136
		CURVE	NARROW	11,184	83.4	134
		FLAT	WIDE	10,786	83	130
		No Lens		10,978	83.6	131
	4000K	CURVE	WIDE	11,440	83.4	137
		CURVE	NARROW	11,307	83.4	136
		FLAT	WIDE	10,905	83	131
		No Lens		11,099	83.6	133
MPS8-VL	3500K	CURVE	WIDE	13,286	94.2	141
		CURVE	NARROW	13,142	94.2	140
		FLAT	WIDE	9,965	72.6	137
		No Lens		14,433	94.4	153
	4000K	CURVE	WIDE	13,434	94.2	143
		CURVE	NARROW	13,288	94.2	141
		FLAT	WIDE	10,076	72.6	139
		No Lens		14,594	94.4	155
MPS8-XL	3500K	CURVE	WIDE	15,291	112.8	136
		CURVE	NARROW	15,045	112.8	133
		FLAT	WIDE	14,650	113.2	129
		No Lens		16,545	113.2	146
	4000K	CURVE	WIDE	15,464	112.8	137
		CURVE	NARROW	15,215	112.8	135
			WIDE	14,816	113.2	131
		No Lens		16,732	113.2	148

HUBBELL Lighting

Columbia LIGHTING

MPS

MULTIPURPOSE LINEAR

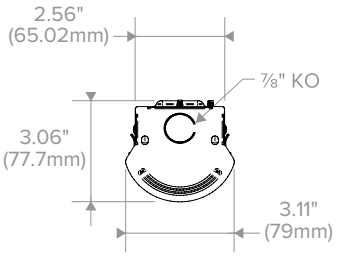
DATE: LOCATION:

TYPE: PROJECT:

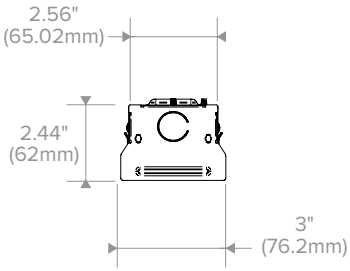
CATALOG #:

DIMENSIONS

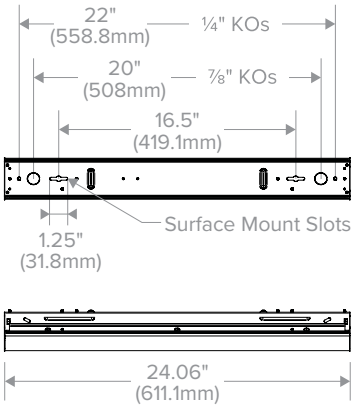
MPS END View - Curve Lens



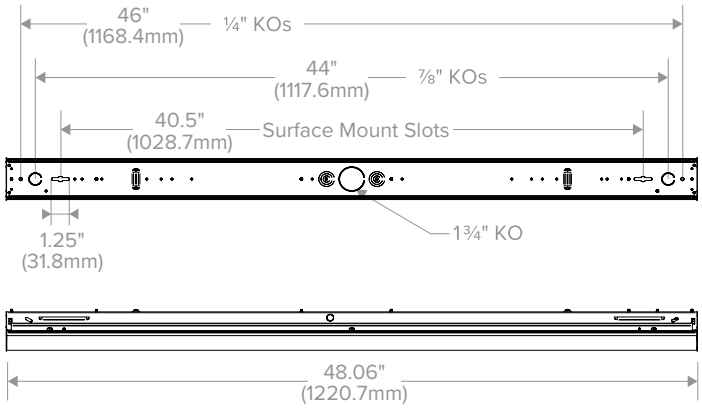
MPS END View - FLAT Lens



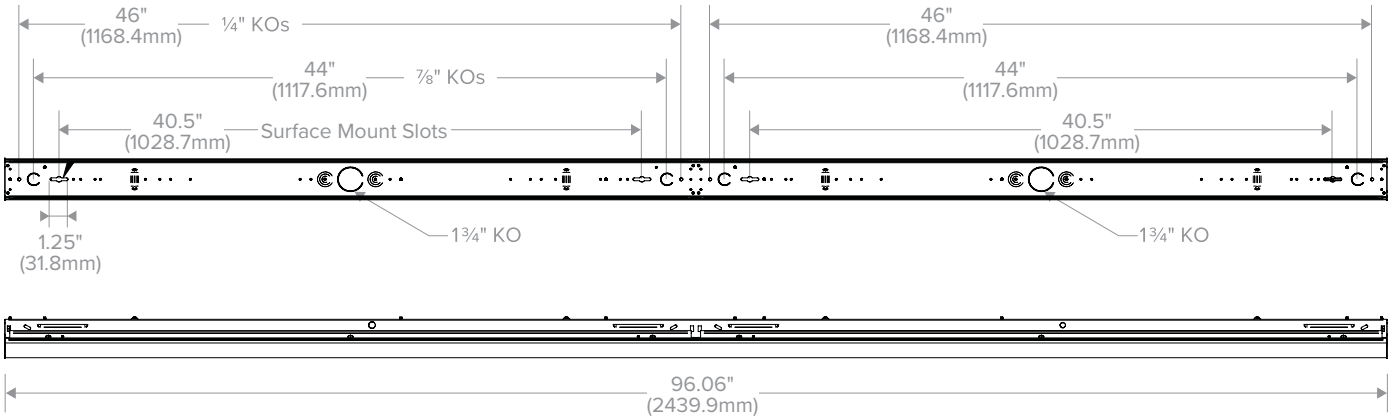
MPS 2' Dimensions



MPS 4' Dimensions



MPS 8' Dimensions



HUBBELL Lighting

Received
By PCM3 at 12:54 pm, April 27, 2023

Columbia LIGHTING

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

MPS

MULTIPURPOSE LINEAR

PHOTOMETRY

MPS4-40ML-CN-EDU

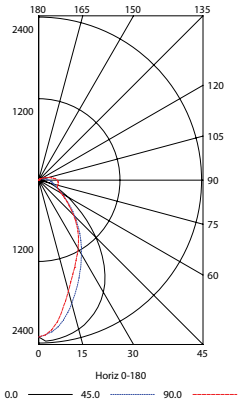
LUMINAIRE DATA

Test No.	**21.00769**
Description	**4' Multi-Purpose Strip-Light w/ Curved, Narrow-Distribution Acrylic Lens**
Delivered Lumens	**4423**
Watts	**31.6**
Efficacy	**140**
Mounting	**Surface**
Spacing Criterion	**0° = 1.22 90° = 0.78**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–30	1472	33.3
0–40	2227	50.4
0–60	3359	75.9
0–90	4126	93.3
0–180	4423	100.0

POLAR GRAPH



MPS4-40ML-CW-EDU

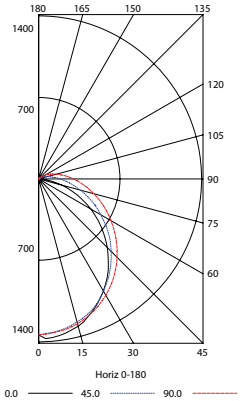
LUMINAIRE DATA

Test No.	**21.00759**
Description	**4' Multi-Purpose Strip-Light w/ Diffuse, Curved Acrylic Lens**
Delivered Lumens	**4469**
Watts	**31.6**
Efficacy	**141**
Mounting	**Surface**
Spacing Criterion	**0° = 1.23 90° = 1.28**

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0–30	1036	23.2
0–40	1693	37.9
0–60	3010	67.4
0–90	4158	93.0
0–180	4469	100.0

POLAR GRAPH



MPS4-40ML-FW-EDU

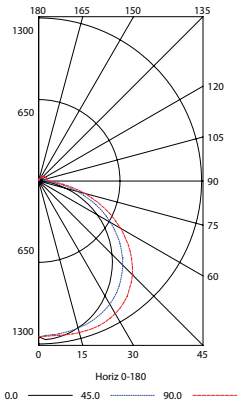
LUMINAIRE DATA

Test No.	**21.00779**
Description	**4' Multi-Purpose Strip-Light w/ Flat, Wide-Distribution Acrylic Lens**
Delivered Lumens	**4279**
Watts	**31.6**
Efficacy	**135**
Mounting	**Surface**
Spacing Criterion	**0° = 1.26 90° = 1.45**

ZONAL LUMEN SUMMARY

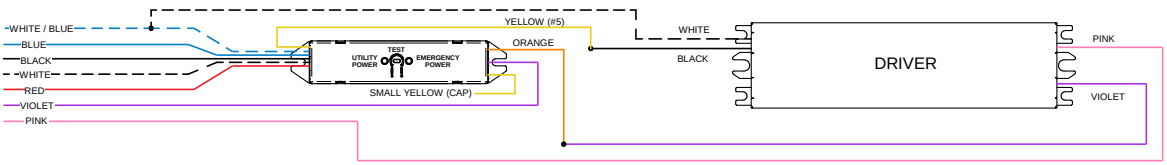
Zone	Lumens	% Luminaire
0–30	1006	23.5
0–40	1684	39.4
0–60	3089	72.2
0–90	4070	95.1
0–180	4279	100.0

POLAR GRAPH



ADDITIONAL INFORMATION

DTS WIRING DIAGRAM (0–10V DIMMING DRIVER SHOWN)



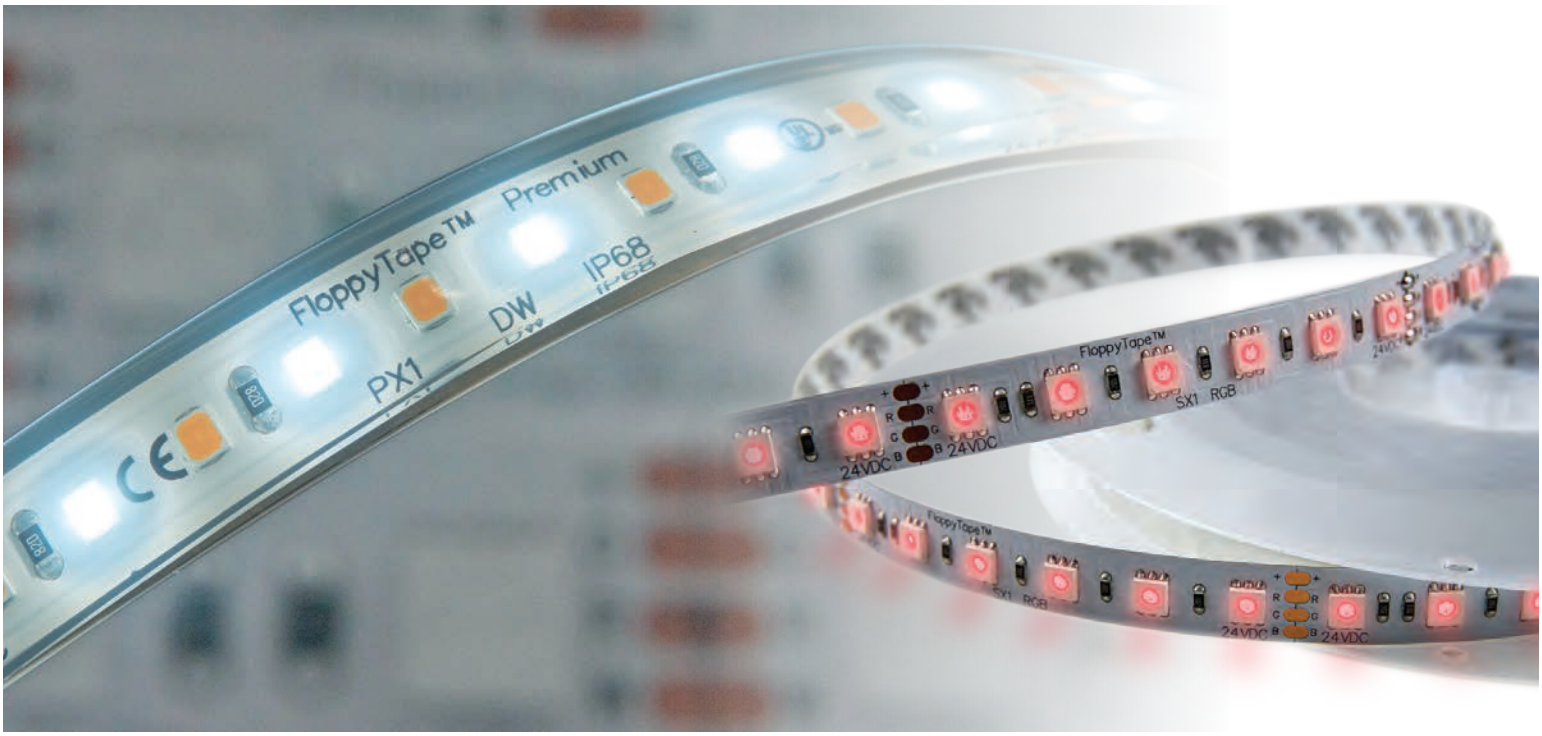
WHITE/BLUE	Emergency Neutral
BLUE	Emergency Line
BLACK	Utility Line (Unswitched Hot)
WHITE	Utility Neutral
RED	Switched Hot
VIOLET	Dimming
PINK	Dimming

HUBBELL Lighting

FloppyTape™

PROFESSIONAL GRADE LED TAPES

Quite Simply the Finest LED Tapes!



- Very high CRI and R9 values! Brilliant colors! Very consistent! Extremely reliable!
- Accurate, full-spectrum, color rendering. True high CRI with no “green.”
- IP68 versions offered, sealed in high transmission, ultra-clear, vacuum-formed silicone
- Wide range of profiles and diffusion accessories offered
- Easy to install! High performance 3M™ adhesive backing affixes to virtually any surface or materials
- Optional quick connection systems available
- Two versions: FloppyTape Premium and FloppyTape Standard

by LITEGEAR™

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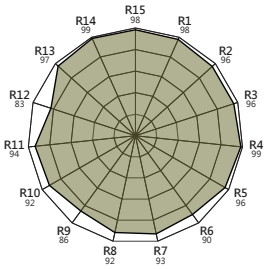
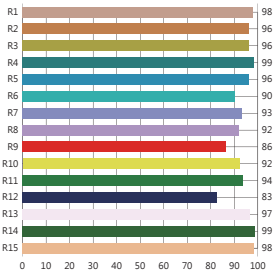
Received
By PCM3 at 12:54 pm, April 27, 2023

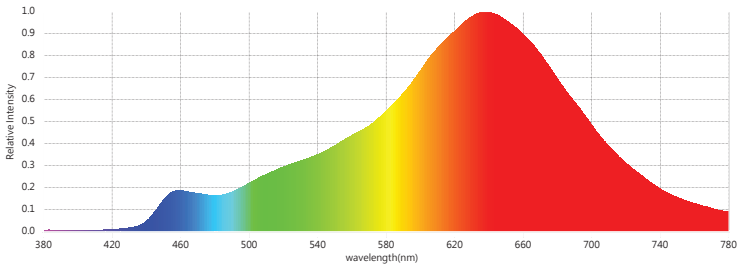
FloppyTape Premium Dynamic White

97+ CRI Dynamic White provides all the benefits of Fixed Tungsten or Daylight, with a range of Kelvin temperatures between 2200K and 6000K.

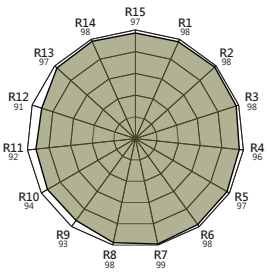
FloppyTape Premium Tungsten Color Rendering Index and Spectral Graph

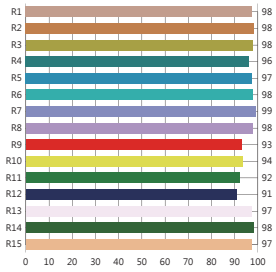


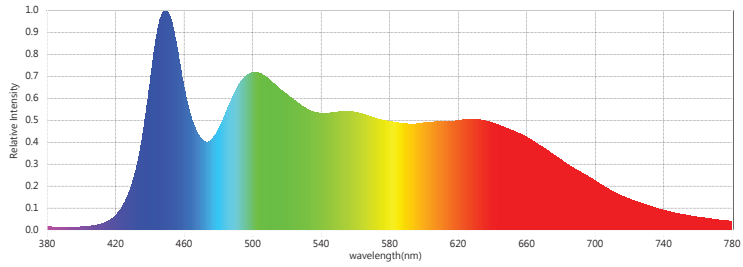




FloppyTape Premium Daylight Color Rendering Index and Spectral Graph







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FloppyTape™

PROFESSIONAL GRADE LED TAPES

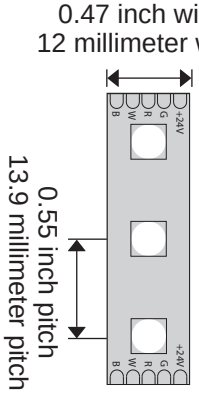
FloppyTape Premium RGBW

4-in-1 chip emitters with Red, Green, Blue, and 97+ CRI 2700K Warm White.

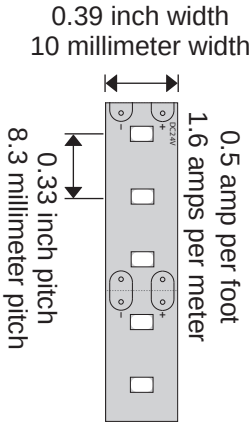
FloppyTape Premium IP68

All FloppyTape Premium tapes are available in ultra-clear, vacu-formed silicone coated IP68 versions.

FloppyTape Premium RGBW



FloppyTape Premium Dynamic White



FloppyTape Standard RGB

3-in-1 chip emitters with Red, Green, and Blue. 84 emitters per meter.

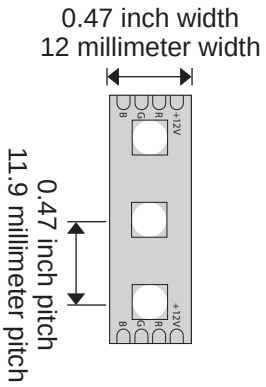
FloppyTape Standard RGBA

4-in-1 chip emitters with Red, Green, Blue, and Amber. 72 emitters per meter.

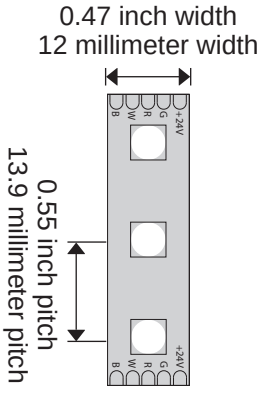
FloppyTape Standard RGBA IP68

4-in-1 chip emitters with Red, Green, Blue, and Amber. 72 emitters per meter. Ultra-clear, vacu-formed silicone coated.

FloppyTape Standard RGB



FloppyTape Standard RGBA



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Specifications

Part Number	Description	Emitters per/m	Rows wide	CCT (k)	CRI	Beam Angle	Length	Width	Height	Lumens per/m	Spacing (mm)	Segments per meter	Min. Segment length	Volts DC	LED Qty	Connector	Drive current (mA per meter)	Power consumption (W/meter)	Constant voltage
FloppyTape Premium																			
FTPPX1DW	FloppyTape Premium X1 Dynamic White 2200-6000K	120	1	2200-6000	97+	120	5 m, 16.4 ft, 196.8 in.	10 mm, 0.39 in.	1.8 mm, 0.07 in.	N/A	8.3	20	50 mm, 1.97 in.	24	600	PH3.F	1600	19.2	CV
FTPPX1DWIP	FloppyTape Premium X1 Dynamic White 2200-6000K IP68	120	1	2200-6000	97+	120	5 m, 16.4 ft, 196.8 in.	12.75 mm 0.5 in	6 mm 0.24 in	N/A	8.3	20	50 mm, 1.97 in.	24	600	PH3.F	1600	19.2	CV
FTPPX1RGBW	FloppyTape Premium X1 RGBW	72	1	2200	97+	120	5 m, 16.4 ft, 196.8 in.	12 mm 0.47 in	2 mm, 0.08 in.	N/A	13.9	24	84 mm, 3.31 in.	24	360	PH5.F	1916.6	23	CV
FTPPX1RGBWIP	FloppyTape Premium X1 RGBW IP68	72	1	2200	97+	120	5 m, 16.4 ft, 196.8 in.	14.75 mm 0.58 in	6 mm 0.24 in	N/A	13.9	24	84 mm, 3.31 in.	24	360	PH5.F	1916.6	23	CV
FloppyTape Standard																			
FTPSX1RGB	FloppyTape Standard X1 RGB	84	1	N/A	N/A	120	5 m, 16.4 ft, 196.8 in.	12 mm 0.47 in	2 mm, 0.08 in.	N/A	11.9	28	35.7 mm, 1.41 in.	24	420	PH4.F	1666.6	20	CV
FTPSX1RGBA	FloppyTape Standard X1 RGBA	72	1	N/A	N/A	120	5 m, 16.4 ft, 196.8 in.	12 mm 0.47 in	2 mm, 0.08 in.	N/A	13.9	24	41.6 mm, 1.64 in.	24	360	PH5.F	1916.6	23	CV
FTPSX1RGBAIP	FloppyTape Standard X1 RGBA IP68	72	1	N/A	N/A	120	5 m, 16.4 ft, 196.8 in.	14.75 mm 0.58 in	6 mm 0.24 in	N/A	13.9	24	41.6 mm, 1.64 in.	24	360	PH5.F	1916.6	23	CV

Drive Options

ProPlex FloppyDrive 4X2
PortableMount
3-wire - PPFD24VP3
4-wire - PPFD24VP4
5-wire - PPFD24VP5

ProPlex FloppyDrive
4x2 IP65 Portable
3-wire - PPFD24VIP3
4-wire - PPFD24VIP4
5-wire - PPFD24VIP5

ProPlex FloppyDrive
DIN Rail
3-wire - PPFDDIN3
4-wire - PPFDDIN4
5-wire - PPFDDIN5

Mean Well 24 VDC PSU
MEASDR24024

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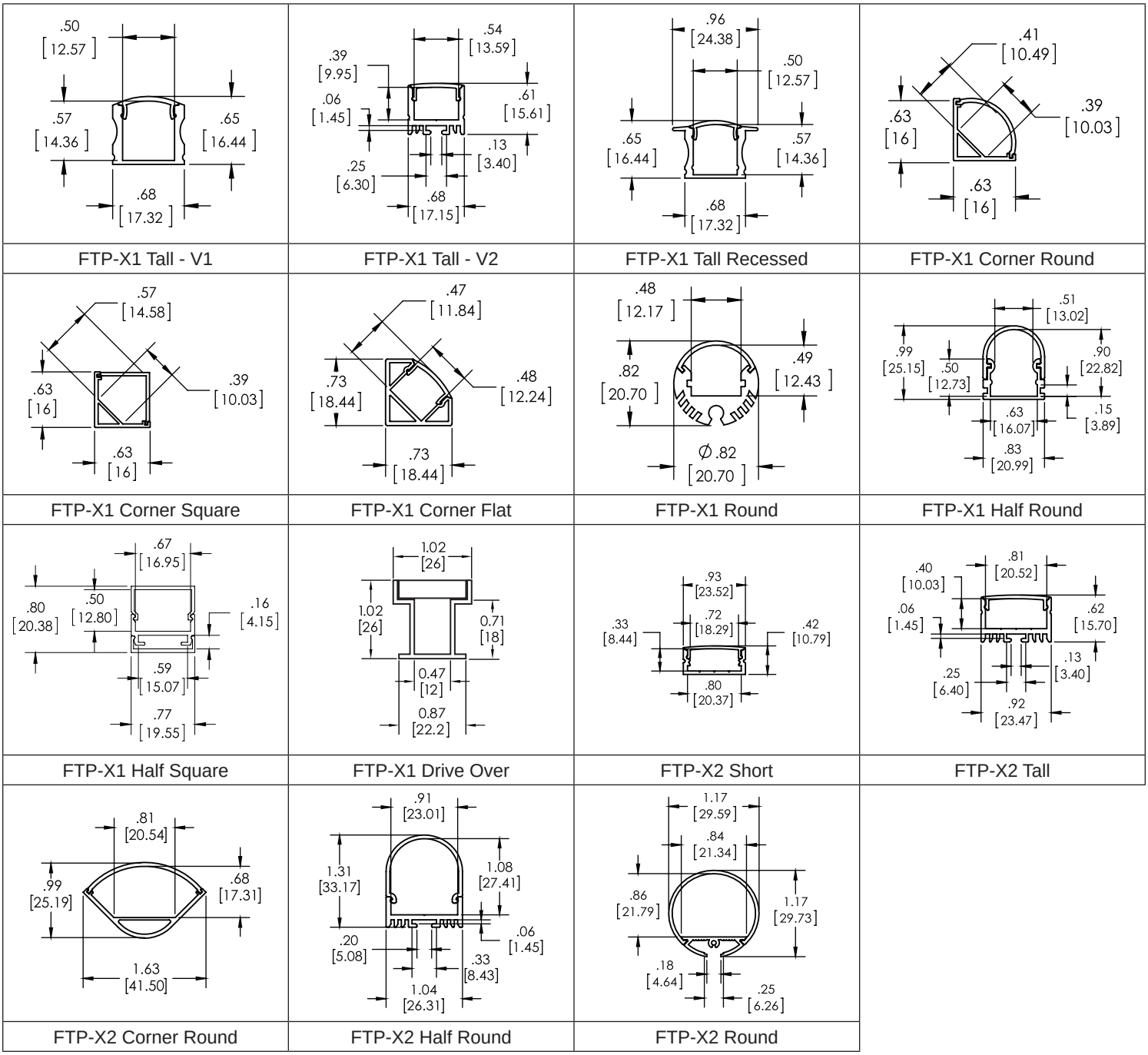
Ready-to-Assemble Aluminum Profiles

Easily install FloppyTape Premium and FloppyTape Standard

- Extruded aluminum channels, with optional frosted polycarbonate diffuser lenses
- 39.4 in. (1 m) long

Dimensions in inches [mm]



FTP-X1 Tall - V1	FTP-X1 Tall - V2	FTP-X1 Tall Recessed	FTP-X1 Corner Round
FTP-X1 Corner Square	FTP-X1 Corner Flat	FTP-X1 Round	FTP-X1 Half Round
FTP-X1 Half Square	FTP-X1 Drive Over	FTP-X2 Short	FTP-X2 Tall
FTP-X2 Corner Round	FTP-X2 Half Round	FTP-X2 Round	

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SOVEREIGN - LED Exit Signs

Architectural Edgelit

EYE APPEAL

Sovereign LED edgelit exit signs set the standard for architectural appeal; always enhancing their surroundings and pleasing even the most discerning eye. Subtle lines and soft curves create a distinctive "floating" edgelit look. Quality construction includes precision die cast aluminum housings with a unique, crystal clear, laser-formed thin acrylic legend. The Sovereign has been designed with the latest high efficiency LED light sources to provide vivid pronouncement of its exit legend with exceptional uniformity and luminance levels – 4X the UL requirement. Engineered for reliability and ease of installation, Sovereign comes in many cost-effective configurations offering superlative quality, performance, and aesthetics.

Construction

- Recessed ceiling back box features universal adjustable mounting brackets with quick-fit retaining clips to suit most ceiling types
- Full size universal, self-adhesive Chevron arrows with template enable on-site configuration
- Lens Panel is "Last-to-Assemble" snap-in for versatility and ease of installation
- Hinged retaining springs eliminate exposed mounting hardware on recessed model
- Slim line low profile surface mount housing eliminates need for recessing box in wall mount applications
- Low profile recessed housing is suitable for old or new work installations and is type IC Rated
- Modular design provides ease of installation and matching configurations
- Quality brushed aluminum sealed finish is standard, optional White, Black, brushed painted Brass finishes available. Consult factory for custom finishes.
- Contoured, crystal clear laser formed edge lit lens
- Custom legends with white LED light source available to order
- Precision pressure die cast aluminum legend holder, trim and surface mount housing
- Available with a range of information signage or custom graphics to order
- Recessed AC Indicator and Test Switch

Surface Wall Mount

Surface Ceiling Mount

Surface End Mount

Electrical

- Unique electronic driver circuit provides current control and protection ensuring optimum LED efficiency and life
- Available with Master/Remote combinations
- Zero current LVCO ensures positive charge acceptance following extended discharge
- Brownout sensing assures emergency illumination during periods of low line voltage
- All versions feature fully integrated electronic components
- Universal 120/277 VAC field selectable input
- Battery Diagnostic Circuit monitors battery status, detects cell failure and issues alert of reduced capacity and the need to replace battery
- Diagnostic Battery Monitoring on all "EM" models
- Premium long life high temperature rated, fused Nickel Cadmium battery, operating temperature 10º to 40ºC

Illumination

- Refractive light guide engineered to optimize LED utilization and illumination uniformity
- Maintenance free LED Light source with 25+ years life expectancy

Certification

- Approved for use in New York City calendar #48851
- UL Listed 3 hour emergency duration standard
- UL 924 Listed by Underwriters Laboratories and meets or exceeds all performance standards as required by NFPA 101, NFPA 70- NEC and OSHA
- California Energy Commission (CEC) Title 20 Compliant

Warranty

- 5 year limited warranty

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Sovereign LED Exit Signs

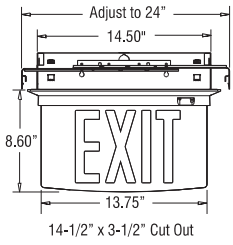
ORDERING GUIDE – SOV

Example: SOV-EM-R-1C-BA-RC-AR-SD-FT

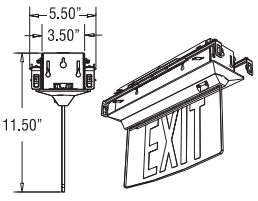
Model	Operation	Legend Size/ Letter Color	Faces/ Background	Trim/ Housing Color	Mounting	Chevron Direction	Options
SOV	**AC** AC Only 120/277 VAC **EM** Battery Backup Emergency	**R** RED Standard 6" EXIT **G** GREEN Standard 6" EXIT **NR** RED 8" EXIT **NG** GREEN 8" EXIT	**1C** Single Face, Clear Background (standard) **1M** Single Face, Mirror Background **2M** Double Face, Mirror Background (Mirror simulates clear background for double face exits) **1W** Single Face, White Background **2W** Double Face, White Background	**BA** Brushed Aluminum (standard) **WH** White Finish **BK** Black Finish **BR** Brushed Brass Painted Finish **CC** Custom Color (specify)	**Standard Mounting** **RC** Recessed Ceiling **SC** Surface Ceiling **SW** Surface Wall **SE** Surface End **Optional Mounting** **MU** Please see Mullion Mount Guide for mounting options **PA** 12 " Swivel Pendant Mount **PB** 24" Swivel Pendant Mount **PC** 36" Swivel Pendant Mount **PD** 48" Swivel Pendant Mount **UP** Back Box Pre Shipped	**UC** Field Installed Adhesive Chevron Indicators **AR** Arrow Right EXIT> **AL** Arrow Left <EXIT **AA** Double Arrow <EXIT> **LR** Arrow Left/ Arrow Right <EXIT/EXIT> (Double Face units only) Factory installation of Chevrons is recommended for Double Face Signs	**DK** Two Circuit Input –Specify Input Voltage AC Models only) **DL** Damp location listed **EU** Euro Legends (Consult factory for full range) **F** Flash in Emergency Mode (EM Models) or continuous Flash in AC models **FA** Flash in AC and Emergency mode on 12-24V (AC or DC) normally-off fire alarm signal (Available for AC and EM models) **FB** FA Option including Buzzer **FZ** F Option including Buzzer **FP** Flat Panel (no curve on panel bottom) **FT** Flat Trim for Recessed Ceiling Mount **IN** Inverted Legend – Use with Mullion Mount **IR** Self-Diagnostics with Infrared remote Testing (EM models only) **TLRT** Infrared hand held Transmitter (order separately) **LL** Remote is the Razor Mk3 LL model with security cover **SD** Self-Test / Self-Diagnostic (EM models Only) **VA** Other Input Supply Voltage (Consult Factory)
SOV							

Fill in fields from categories above and complete type and part number.

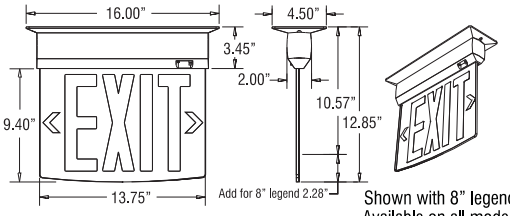
Type Number:	*Full Part Number:*



14-1/2" x 3-1/2" Cut Out

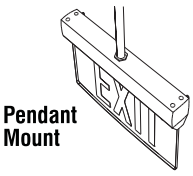


Recessed Ceiling Mount

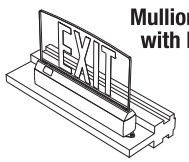


Surface Ceiling Mount

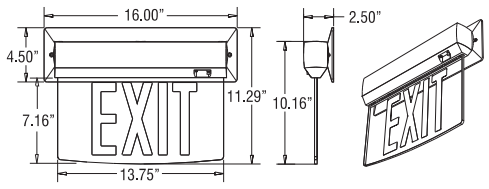
Shown with 8" legend Available on all models



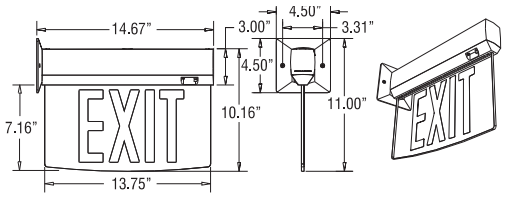
Pendant Mount



Mullion Mount with Inverted Legend



Surface Wall Mount



Surface End Mount

Power Consumption				
Type		Volts	Max Watts	Power Factor
RED	AC Only	120 / 277	1.5	.70
RED	Battery Backup	120 / 277	2.5	.70
RED	Battery Backup with Remote	120 / 277	3.0	.73
GREEN	AC Only	120 / 277	2.3	.70
GREEN	Battery Backup	120 / 277	3.0	.76
GREEN	Battery Backup with Remote	120 / 277	4.0	.81

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DIVISION 27
COMMUNICATIONS

SECTION 27 05 36 - CABLE TRAY FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit Product Data Sheets for all cable trays, all related components, and NEMA VE1.

1.3 SUBMIT CABLE TRAY SUPPORT DETAILS.

A. Provide Reproducible Floor Plan Shop Drawings, with the same scale as the Contract Floor Plan Drawings. The Drawings shall show the proposed Cable Tray Layout Plan views. An elevation view shall be provided at each riser or change in horizontal elevation in the cable tray. The Shop Drawing Plans shall show all building elements, expansion/seismic joints, air ducts, piping and components that cross the path of the cable tray, along with separation of the cable tray from the crossing components.

PART 2 - PRODUCTS

2.1 CABLE TRAY

A. Material and installation shall comply with NEMA - "VE1" latest edition, Cable Tray Systems', NEC., California Title 24 and Title 8. As manufactured by Globe Tray, Chalfant, P-W Industries or equal.

B. Cable tray shall include two longitudinal side rails, ladder type, with transverse 6 inches rung spacing welded to side rails. Rungs shall have a minimum cable-bearing surface of 0.75-inches. Rungs shall not extend below bottom of side rails. Splice plates shall be locking bolt type to connect tray sections together without decreased tray strength. Provide expansion/ deflection fitting at each building seismic and expansion joint crossing.

C. Trays shall be steel or aluminum. Steel trays shall be hot dip galvanized after fabrication ASTM A 123 with ANSI type 304 and 316 stainless steel hardware. Aluminum trays shall be extruded from 6063-T6-aluminum alloy with 5052-H32-aluminum alloy hardware.

D. The complete cable tray system and supports shall be designed for the following minimum uniformly distributed working load but not less than indicated on the Drawings, with a 1.5 minimum safety factor, when supported as a single span. In addition, the cable tray shall support 200 pounds concentrated at span midpoint without permanent distortion.

1. Cable tray wider than 12-inches or deeper than 6 inches, live loading 200 pounds per linear foot.
2. Cable tray 12-inches or less in width and 6 inches or less in depth live loading 100 pounds per linear foot.

E. Provide ladder type "elbows", "tees", horizontal "crosses", expansion connectors, reducer sections, connectors, straight sections, curved sections, fittings, supports, hangers, blind ends, risers and accessories to provide a complete installation of the cable tray shown on the Drawings. Provide trapeze brackets and individual threaded hanger suspension rods in any combination required to support the cable tray system. Provide all materials and labor necessary for a complete installation.

F. Cable tray runs shall be minimum 6-inches deep by 12-inches wide, but not less than indicated on Drawings. Dimensions are outside dimensions of the cable tray rails.

G. Similar cable tray parts and hardware shall be interchangeable with each other. The cable tray system shall be free of sharp edges, burrs or projections that can damage cable insulation.

PART 3 - EXECUTION

2.2 CABLE TRAY

A. Cable Trays shall be seismically anchored and supported to the building structure to prevent horizontal or lateral movement with 1.0-gravity acceleration, including specified live load conductor capacity, complying with State of California Seismic Codes. Support hangers from the building structure shall provide a 2.0 weight carrying safety factory including specified live cable weight. Cable tray hangers shall be provided with a spacing to insure the maximum cable tray deflection with the specified live cable loading does not exceed 0.75-inches between supports and hangers. In no case shall cable tray support or hanger spacing be greater than 12-feet on center.

B. Punching or drilling of structural side members shall not be performed except for splice plate bolt-holes.

C. Provide expansion adapters where cable trays cross a building expansion joint, and to comply with Tray Manufacturer's recommendation for the Cable Tray Thermal Expansion Requirements.

D. All Cable Trays including non-connected tray sections shall be made electrically continuous. Provide grounding jumpers minimum equivalent to #8AWG, where required to provide continuity.

E. Grounding for Cable Trays shall comply with Article 318-6 of NEC.

F. Provide curved "radius" cable trays at each "horizontal" or "vertical" change in direction of the cable tray. Provide "tee" and "crosses" at each intersection of Cable Trays. Provide "blind ends" at the end of each cable tray "run".

G. Provide removable fire blocking "bag style" at Cable Tray penetrations of fire barriers.

END OF SECTION

SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Requirements of this Section apply to all Sections of Division 27.

B. This Project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 019100 General Commissioning Requirements. The Commissioning process, which the Contractor is responsible to execute, is defined in Section 019100 General Commissioning Requirements. A Commissioning Agent (CxA) appointed by the College will manage the Commissioning process.

1.2 RELATED WORK

A. Section 01 00 01 General Requirements

B. Section 01 00 02 General Requirements

C. Section 01 91 00 General Commissioning Requirements.

D. Section 01 33 23 Shop Drawings, Product Data, and Samples.

1.3 SUMMARY

A. This Section includes Requirements for Commissioning the Facility Communications Systems, related subsystems and related equipment. This Section supplements the General Requirements specified in Section 019100 General Commissioning Requirements.

B. Refer to Section 01 91 00 General Commissioning Requirements for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

Refer to Section 01 91 00 General Commissioning Requirements for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 27 is part of the construction process. Documentation and testing of these systems, as well as training of the College's Operation and Maintenance Personnel in accordance with the Requirements of Division 27, is required in cooperation with the College and the Commissioning Agent.

B. The Commissioning shall include the systems listed in Section 01 91 00 General Commissioning Requirements.

1.6 SUBMITTALS

A. The Commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the College prior to forwarding to the Contractor. Refer to Section 01 33 23 Shop Drawings, Product Data, and Samples for further details.

B. The Commissioning process requires Submittal review simultaneously with engineering review. Specific Submittal Requirements related to the Commissioning process are specified in Section 01 91 00 General Commissioning Requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

Commissioning of Communications systems will require inspection of individual elements of the communications system construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning Plan to schedule communications systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the College and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to Section 019100 General Commissioning Requirements for submittal Requirements for Pre-Functional Checklists, Equipment Startup Reports, and other Commissioning Documents.

3.3 CONTRACTORS TESTS

Contractor tests as required by other Sections of Division 27 shall be scheduled and documented in accordance with Section 01 00 00 General Requirements. All testing shall be incorporated into the Project schedule. Contractor shall provide no less than 7-calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady State conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will

witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 General Commissioning Requirements, for additional details.

3.5 TRAINING OF PERSONNEL

Training of the College Operation and Maintenance Personnel is required in cooperation with the College Representative and the Commissioning Agent. Provide competent, Factory Authorized Personnel to provide instruction to Operation and Maintenance Personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit Training Agendas and Trainer resumes in accordance with the Requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the College Representative after submission and approval of formal Training Plans. Refer to Section 01 91 00 General Commissioning Requirements and Division 27 Sections for additional Contractor Training Requirements.

END OF SECTION

SECTION 27 11 00 — COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 GENERAL

A. Build-out (installation of racks, cabinets, cable runway, cable management, etc.) of Instructional Building #2, Building-Entry, BDF and IDF shall be provided by the Cabling Contractor.

B. Backboards, conduits, sleeves, power and grounding in the Instructional Building #2, Building-Entry, BDF and IDF shall be provided by the General and Electrical Contractor.

1.2 SECTION INCLUDE

A. Installation of freestanding and wall-mount Equipment Racks

B. Installation of Cable Management — Vertical and Horizontal

C. Installation of wall-mounted 110 Termination Blocks

D. Installation of Backbone UTP Protection Panels and Units

E. Installation of Category 6 UTP Patch Panels

F. Installation of Category 6 UTP Patch Cables

G. Installation of Fiber Optic Patch Panels

H. Installation of Fiber Optic Patch Cables

I. Installation of Grounding

J. Installation of Overhead Cable Runway

K. Installation of Voice Cross-connects

1.3 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in backbone cables, and
provide spare positions in cross-connects and terminal strips to accommodate 20% future increase in active services.

1.4 MOUNTING ELEMENTS

A. Pathways: Comply with Section 27 05 28 Pathways for Communications Systems.

B. Backboards: 0.75-inch, ACX interior-grade, fire-retardant-treated plywood painted with two coats of fire- retardant white paint.

C. All free standing racks and cabinets shall be seismically securely to Zone-4 Requirements to the concrete floor using minimum .25-inch hardware or as required by local codes.

D. Racks shall be placed with a minimum of 36 inches clearance from the walls on three sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at one end of the row.

E. All racks and cable runways shall be grounded to the telecommunications grounding bus bar in accordance with Grounding System Requirements.

F. Rack-mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

G. Wall-mounted termination block fields shall be mounted on 4 feet by 8 feet by 0.75-inch ACX void free plywood. The plywood shall be mounted vertically 12 inches above the finished floor. The plywood shall be painted with two coats of white fire retardant paint. Wall-mount termination block fields shall be installed with the lowest edge of the mounting frame 18 inches from the finished floor.

PART 2 – PRODUCTS

2.1 TWO-POST RACKS

A. Two-post racks shall have power distribution and cable management for server and networking applications in IT environments.

B. ICT Contractor shall provide, install, ground and seismic brace 2-post racks in the BDF and IDF’s.

C. The unit shall conform to TIA-610 Standard for, Racks, Panels and Associated Equipment and accommodate industry standard 19-inch rack mount equipment.

D. The unit shall be designed with four vertical posts to allow rack mount equipment installation utilizing four vertical mounting rails.

E. The unit shall provide 45U of equipment vertical mounting space (IU—1.75-inch or 44.45mm).

F. The vertical mounting rails shall be adjustable to allow different mounting depths.

G. The unit shall include at least 50 sets of mounting screws, caged nuts, bolts and cup washers, and caged nut installation tool for the mounting of equipment inside the unit.

H. All weight bearing components shall be constructed from steel no less than 0.9mm (20 gauge).

I. All metal parts shall be painted using a powder coat paint process.

   l. Racks shall be black over a brushed aluminum finish.

J. Plastic materials shall comply with Underwriters Laboratory Specification 94 with V-1 rating (UL94 V-1) or better.

K. Provisions shall be provided for all rack-mounted equipment to be earthed or grounded directly to the frame.

L. Unit shall include a grounding kit containing terminated green/yellow jumper wires and associated hardware.

M. Units shall be equipped with vertical and horizontal wire management.

N. Racks will require two PDU brackets per cabinet.

O. Freestanding modular aluminum units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

P. Material:

1. Approximate Module Dimensions: 84 inches high by 19 inches wide by 3 inches channel depth.
2. Racks shall be all high strength, lightweight 6061-T6 aluminum extrusion construction.
3. Racks shall be equipped with two top angles or top bars and heavy-duty assembly hardware.
4. Racks shall have EIA hole pattern on front and rear.
5. Racks shall assemble as 19 inches with no additional hardware.
6. Racks shall have EIA Channel: 3 inches x 1.265 inch x 0.25 inch thick flange.
7. Racks shall have Base Angles: 3.5 inches by 6 inches by 0.125 inch thick (pair).
8. Racks shall have Top Angles: 1.5 inch by 1.5 inch by 0.25 inch (pair).
9. Racks shall have Top Bars: 1.5 inch by 0.25 inch (pair).
10. Racks shall have a weight capacity of 1000 lbs. Weight must be evenly distributed.
11. Racks shall be black over a brushed aluminum finish.
12. Racks shall provide floor and ceiling access for cable management and distribution.
13. Racks shall provide pre-drilled base for floor attachment of rack.
14. Racks shall be seismic/earthquake braced.
15. Racks shall be black in color.
16. Contractor shall provide cable runway elevation kit,

K. Manufacturer:

1. Chatsworth Products, Inc. p/n# 55053-703
2. Or Equal

2.2 HEAVY DUTY EQUIPMENT SHELF FOR 3-INCHES CHANNEL

A. Shelves, black in color, shall be installed at the bottom of freestanding racks. These 20-inches deep, 200 lb. rated shelves are needed to support UPS units.

B. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.3 CABLE RUNWAY (LADDER RACKING)

A. Cable runway support shall be installed in Telecommunications Rooms as shown on the Drawings. Size: 18 inches wide.

B. Classified by Underwriters Laboratories (UL) as suitable for equipment grounding.

C. Cable Runway shall be used for voice and, or data and video communications cabling only. No electrical wiring shall be placed on runway with voice and data cabling.

D. Wall angle supports shall be steel angles. Ends to be smooth without hooks or projections. Brackets shall be able to support an end load of 600 lb. with a safety factor of 1.65.

E. Elbows, Tee’s, 90degree bends and crosses: All horizontal and vertical 90 degree elbows, tee’s, 90 degree bends and crosses shall be made with right angle couplings which clamp to the runway without the need for drilling or cutting.At all horizontal 90-degree bends, tees, and crosses, provide adjustable junction splice kits for large radius cable bends.

F. Where cables transition from runway to termination equipment or racks, provide cable radius managing waterfall attachments.

G. Seismically supported by end wall supports, angular wall support and communications equipment racks.

H. Protective End Caps on all exposed cable runway ends.

I. Black baked enamel finish.

J. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.4 WIRE MANAGEMENT

A. Materials

B. All equipment racks shall be equipped with vertical and horizontal wire management organizers. All horizontal wire managers shall be heavy duty painted black metal units designed specifically to connect to equipment frames. All vertical wire managers shall be aluminum with a black finish. All wire managers shall be secured to the frames and shall provide a clear and unobstructed pathway in which to route the cables.

1. The Vertical cable manager shall be constructed of metal backbone with pass through holes and plastic cable management fingers.
2. The cable management fingers shall be molded out of plastic and incorporate bend radius control throughout the entire length.
3. The panel shall have a metal door that will be capable of opening to the left or right when mounted.
4. The panel shall be capable of mounting to EIA standard channel, deep channel and telco style racks.
5. Vertical wire managers shall be double-sided 4.4 inches wide by 7 feet tall. Vertical wire mangers shall have evenly 1 RMU spaced wire rings designed to maintain jumper, patch, or cross-connect wire in place.
6. Vertical wire managers shall be designed to extend past the frame to allow placement of equipment in any position within the rack. When mounted between equipment frames, they shall be designed to direct cables into either frame and shall be securely mounted to both units.
7. Vertical wire managers shall be equipped with rigid aluminum Switch Gate Door/Cover with reversible access that conceals cable.
8. Vertical wire managers shall be provided black in color.

C. Horizontal Wire Managers (Equipment Racks)

1. The in-frame horizontal managers shall be 2 RMU in height and shall extend from side rail to side rail.
2. Double-sided design and pass-through slots for easy organization of front and rear cables.
3. Include cable guide fingers at 1.75-inch intervals for proper cable bend radius and organization of patch cords.
4. Flanged pass-through slots to route cables to the back.
5. Include Snap-on, hinged door/cover.
6. Black in color.

D. Horizontal Wire Managers (Wall-Mount Brackets)

1. Shall be 2 RMU in height and shall extend from side rail to side rail.

2. Single-sided design.
3. Include cable guide fingers at 1.75-inch intervals for proper cable bend radius and organization of patch cords.
4. Include Snap-on, hinged door/cover.
5. Black in color.

E. Cable Management for Wall Racks

1. Cable management rings shall be installed onwall-mount racks.
2. Black polymer-blend material that is UL Rated for use in plenum spaces.
3. Flexible material holds bundles secure while also allowing easy entrance of additional cables.
4. Internal diameter 3-inches.
5. Kit includes six rings and mounting hardware

F. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

2.5 PLYWOOD BACKBOARD

A. The General Contractor shall provide and install all MPOE and Telecommunications Room backboards.

B. Provide 0.75-inch (19.05 mm) ACX void-free, fire rated plywood as noted on construction documents.

C. All walls noted on Construction Documents must be covered with 0.75 inch (19.05 mm) thick by 8 feet-0 inches (2438.4 mm) high ACX plywood, painted with two coats of insulating fire-retardant white paint.

D. Backboards shall be mounted vertically, starting 6 inches (152.4 mm) above the finished floor, and secured to the walls.

E. All backboards are to be constructed of 4 feet (1219.2 mm) by 8 feet (2438.4 mm) plywood.

F. All plywood panels must be mounted in contact with one another, leaving no gaps between sheets.

G. All exposed edges must be chamfered. Screws, bolts, washers and/or nuts are to be counter sunk to be flush with the surface of the plywood,

2.6 WALL-MOUNTED 110 WIRING BLOCKS

A. Application: Shall be used to terminate voice station and voice backbone cable.

B. Compliance: Comply with ANSI/TIA-568-B.1 and ANSI/TIA-568-B.2 Category 5 Specifications Requirements and associated Addendums, ANSI/TIA-606-B Labeling Standards.

C. All voice station cable terminations shall be made on wall-mounted 110 wiring blocks with C4 connectors.

D. Intra-building voice backbone cable terminations shall be made on wall-mounted 110 wiring blocks with C5 connectors.

E. All blocks shall be UL listed.

F. Characteristics: The 110 Wiring Blocks shall:

1. Facilitate cross-connection and/or interconnection using either cross-connect wire or patch cords.

2. Be manufactured using fire retardant molded plastic with the base consisting of horizontal index strips for termination up to 25-pairs of conductors.
3. Support termination of 22, 24 and 26 AWG solid conductor.
4. Be available in S0-, 100- and 300-pair sizes. Sizes specified within Drawings contain access opening for rear to front cable routing to the point of termination.
5. Have termination strips on the base to be notched and divided into 4-pair and/or 5- pair increments.
6. Have clear label holders with the appropriate colored inserts available for the wiring blocks. The insert labels provided with the basis of circuit size (1-, 3-, 4- or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.
7. Have bases available in 19-inch (482.6 mm) panels and high-density frame configurations for rack or wall mounting with cable management hardware.
8. Have connecting blocks used for either the termination of cross-connect jumper wire or patch cords. The connecting blocks shall be available in 2-, 3, 4- and S-pair sizes. All connecting blocks shall have color- coded tip and ring designation markers and be single piece construction.
9. Be capable of accommodating a minimum of 200 repeated insertions without resulting in permanent deformation.

G. Manufacturer:

1. AMP
2. Panduit
3. Leviton
4. Or Equal

2.7 PROTECTOR PANELS AND UNITS

A. Application: Inter-building and entrance cable protection will be Vendor’s protector panel equipped with protector units. Protector panels shall meet NEC Article 800, Part C Requirements. Protector panels shall provide protection for communications equipment and circuits exposed to voltage surges and sneak currents. The protector panel shall be equipped with 110-style terminations in and out.

B. Protector units shall be UL 497 listed for primary circuit protection. Protector units shall provide protection for communications equipment and circuits exposed to voltage surges and sneak currents. The protector units shall be equipped with solid state surge arrestors for sneak current protection.

C. Manufacturer:

1. Circa
2. Marconi
3. Or Equal

2.8 UTP CATEGORY 6 PATCHPANELS

A. Application: Use to terminate all horizontal data station cabling.

B. Compliance: Listed as complying with ANSI/TIA-568-B.1 and ANSI/TIA-568-B.2 Category 6 Specifications Requirements and associated Addendums, ANSI/TIA- 606-B Labeling Standards.

C. Characteristics: Patch panels shall:

1. Be available in 48-port high-density configurations.
2. Modular Patch Panels shall be of a metal design with snap in four position and six position molded faceplate frames.
3. Patch panels shall be available with labels.
4. Patch panel modular jack assemblies shall be color coded as specified within Section 17140-3.3.

5. Be mountable in freestanding equipment rack.
6. Be labeled above the RJ4S module.
7. Be 2 RMU in height and shall extend from side rail to side rail.

D. Manufacturer:

1. AMP
2. Panduit
3. Ortronics
4. Or Equal

2.9 UTP CATEGORY 6 PATCH CABLES

A. UTP Patch Cables. Patch cables for unshielded twisted pair cable shall be Category 6 rated and shall be equipped with factory-attached connectors to interconnect equipment mounted on the racks of the distribution frame and to connect computer stations to outlet locations.

B. Patch cords may also be used for patching applications; not to exceed 20 feet. Quantity required for 100% port population at both ends with 10% spare.

C. Contractor shall provide:

1. BDF/IDF Patch Cords — 6-inches in length, Category 6 and colored according to the following:

a. Green for instructional network
b. Blue for non-instructional network
c. White for everything else
d. Number of each color to be confirmed with Owner or District Representative.

2. Workstations — 10 feet in length, Category 6, black in color.

D. Manufacturer:

1. AMP
2. Panduit
3. Ortronics
4. Or Equal

2.10 FIBER PATCH PANELS

A. Manufacturer: Ortronics or District approved equal.

B. Provide panel for maintenance and cross connecting of fiber optic cables.

C. Panel shall be constructed of 0.125-inch minimum aluminum and shall have connectors which interface the inside plant fiber optic jumper cable with the outside plant fiber optic cable.

D. Panels shall be equipped with engraved laminated plastic nameplates above each connector.

E. Rack-mounted fiber patch panels shall be equipped to terminate or splice the incoming inter-building fiber and any required backbone or interconnect cables.

F. Each cable must be properly dressed.

G. These units will terminate the fiber optic cables, provide a place for jumper cables and will provide room to terminate additional optics.

H. Panel shall provide capacity for minimum of 12 fiber optic strands. Larger capacity patch panels shall be determined at site walk.

I. Panel shall be 100% populated with type LC couplers and adapter plates.

J. All connectors and couplers will be type LC.

K. The fiber optic patch panel connections shall provide 0.4 dB or less insertion loss.

2.11 FIBER OPTIC PATCH CABLES

A. Manufacturer: Superior Essex, or District approved equal.

B. Fiber Optic Patch Cables shall be Multimode or Single Mode patch cords pre-made to connect fiber optic equipment with fiber optic cross connects, interconnects and outlets.

C. The patch cords (jumpers) shall be impact-resistant, duplex fiber cables with LC connectors, of the same performance characteristics as the Single Mode fiber backbone being connected.

D. These fiber optic patch panel connections shall provide 0.4 dB or less insertion loss and provide connection between the Active LAN devices and the Fiber Optic patch panel. Quantities for 100% fiber strand population at both ends plus 10% Spares.

E. Contractor shall provide:

1. IDF Patch Cords — 1 Meter in length, LC connectorized, Multimode and Single Mode, duplex, fiber optic patch cord.
2. MDF/BDF Patch Cords — 3 Meter in length, LC connectorized, Multimode and Single Mode duplex, fiber optic patch cord.

2.12 GROUNDING SYSTEM

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA- 607 Telecommunications Bonding and Grounding Standard.

B. The TBB shall adhere to the recommendations of the ANSI/TIA-607 standard, and shall be installed in accordance with industry best practice.

C. The General Contractor shall be responsible for having a licensed Electrical Contractor provide and install the TBB to the building service entrance ground.

D. The main entrance facility shall be equipped with a Telecommunications Main Grounding Bus bar (TMGB). The Site MPOE and each Telecommunications Room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached. Installation of building ground systems shall be the responsibility of the Electrical Contractor.

E. All racks, cable runway, metallic backboards, cable sheaths, etc. entering or residing in the MPOEs and Building Telecommunications Rooms shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Bonding of cable sheaths and equipment within these rooms shall be the responsibility of the Cabling Contractor.

F. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non- insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this Specification.

G. Manufacturer:

1. Chatsworth Products, Inc.
2. Or Equal

PART 3 - EXECUTION

3.1 EQUIPMENT RACKS, SHELVES AND SERVER RACKS

A. Coordinate all work for final mounting locations of all equipment.

B. Provide and install all cable runways as defined on Telecommunications Drawings and Specifications.

C. Provide and install 324-inch fire rated plywood backboards within Telecommunications Room as identified within Telecommunications Drawings and Specifications.

D. Provide and install all equipment racks and cabinets

E. Provide seismic anchoring of all racks and cabinets to meet compliance.

F. Provide and install all vertical and horizontal wire managers.

G. Provide and install required rack-mounted patch panels and wall-mounted 110 termination hardware.

3.2 CABLE MANAGEMENT

A. Provide and install two vertical wire management panels to each 19-inch x 7-feet equipment rack installed.

B. Provide and install one 2U horizontal wire management panel for each UTP patch panel and fiber optic enclosure installed.

3.3 UTP PATCH PANELS

A. Provide and install 48-port, Category 6 patch panels within Telecommunications Rooms.

B. Contractor shall verify and provide exact quantities required.

3.4 FIBER OPTIC PATCH PANELS

A. Provide and install fiber optic patch panels within the building MPOE and Building Telecommunications Rooms.

B. Provide and install necessary adapter and blank panels.

3.5 VOICE TERMINATION BLOCKS

A. Provide and install 110 type termination blocks with wiring troughs within Telecommunications Rooms.

B. Provide lightning protection termination terminals for all outside plant/underground cable installed.

C. Contractor shall verify and provide quantities required.

3.6 CROSS CONNECTS

A. Provide all cross-connect (1 pr. hook-up) wire required in the Instructional Building #1 MPOE and TRs.

B. Backbone cable to backbone cable, cross-connect all pairs.

C. Backbone to voice station cable and emergency telephone cable, cross-connect one pair per station.

3.7 CABLE RUNWAY (LADDER RACKING)

3.8 Provide and install all ladder rack as defined within the Telecommunications Drawings.

3.9 Provide and install all required mounting/supporting hardware required.

3.10 TIE WRAPS

3.11 Provide and install Velcro cable ties to manage and secure all installed cables within MPOEs and Telecommunications Rooms.

3.12 GROUNDING

3.13 The Electrical Contractor shall provide and install the Telecommunications grounding system to each MPOEs and Telecommunications Rooms.

3.14 Provide and install grounding bus bars within MPOEs and Telecommunications Rooms as identified on the Telecommunications Drawings.

3.15 The Cabling Contractor shall provide and install grounding within BDF and IDF Rooms as follows.

1. Inter-building cable sheaths shall individually bonded to the TGB.
2. Each rack shall be individually bonded to the TGB.
3. Each cable runway section shall be bonded together with ground straps.
4. Cable runway strapped system shall be bonded to the TGB.
5. Ground all equipment within Telecommunications Room with a minimum #6 AWG conductor.

END OF SECTION

SECTION 27 20 00 - ELECTRONIC NETWORK SYSTEMS INFRASTRUCTURE

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26.
2. General Provisions and Requirements for electrical work.

B. Provide Electronic Network Systems Infrastructure for the following systems:

1. Computer Data Networks
2. Telephone and Intercom Voice Communications
3. Other special systems described in the Contract documents.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Drawings Submittals

1. Drawings shall be submitted on reproducible sepias and AutoCAD® Version 2.2 (or later revision) data files on CD/DVD-ROM disk, WINDOWS®-XP or Version-7 or Version-8 format.
2. Submit redrawn Building Floor Plan for each building area, same scale as the Contract Drawing.
3. Plans shall show walls, doors, windows, furniture, infrastructure, outlets and network systems equipment locations. Show point-to-point interconnecting cables, pathways, conduit, conduit sizes, circuit types, along with circuit identification names, numbers and quantities between all components.
4. Provide scaled Elevation Drawings of each equipment rack, terminal blocks, terminal backboard and terminal room/closet showing location and arrangement of each equipment component, outlet and cable training provisions, with estimated weight of each complete assembly.
5. Submit block wiring diagrams showing major system components, outlets, equipment racks, terminal blocks, signal loss with interconnecting circuit conductors, splices, portable patch cords and connectors. Riser type diagram shall be provided if the building has more than one floor level, with information shown on riser diagram corresponding for each respective floor

B. Submit Manufacturer's standard catalog data for each component. The submittal shall be arranged in the order of the Specification and shall list the Specification paragraph number, the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the

brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of items. The data sheet shall completely describe the proposed item. Where modification to the equipment is necessary to meet the operational Requirements of the Contract Documents, the brochure shall include complete Mechanical and Electrical Shop Drawings, detailing the modification. The brochure shall include a listing of the outlet rough-in Requirements for every device and equipment item. The applicable symbol which illustrates that rough-in item on the job plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by Field Personnel. Submit elevation and dimensional information.

C. Performance Calculation:

1. Provide engineered calculations showing the Passive Cable System Signal Attenuation losses of the proposed installed system. The intent is not to require calculations for every system segment, port and outlet. The intent is to require engineered calculations for proposed typical worst case port to port head end to farthest distance outlet and patch port to outlet signal attenuations.
2. Provide calculations for a minimum of 50 complete channel/circuit paths. The calculations shall include attenuation insertion losses for each system component including individually itemized cable-fiber/wire; outlet, termination, connector, electronic component (if any), coupler and patch cord along the entire path from the head end equipment to the end use outlet.
3. The calculations shall serve as the basis for verifying the system performance with the system testing specified in the Contract Documents.

D. Provide proposed nameplate and outlet identification/color coding system. Indicate proposed identification naming sequence and methods, itemized for review.

E. Submit Manufacturer Certified Test Reports showing test documentation for the proposed material that the material meets or exceeds the performance standards defined in the Contract Documents. The testing and results shall reflect worst case performance based on a minimum of ten samples. Tests shall be certified by a Nationally Recognized Independent Test Lab (i.e., ETL, UL, etc.). The Manufacturer shall certify in writing the material has been manufactured and tested to comply with the Requirements defined in the Contract Documents.

F. Submit three samples of each of the following, fully assembled with 24-inches of cable type connected:

1. Copper wire outlet and connector, with each type of specified inserts.
2. Copper cables and patch cords, each type.
3. Fiber optic cables and patch cord each type.
4. Mechanical splice - fiber optic.
5. Fusion splice - fiber optic.
6. Fiber optic outlet and connector each type.
7. Fiber optic cable connector each type of termination, with interconnection coupler.
8. Patch panel each type.
9. Coverplate each type.

1.3 APPLICABLE STANDARDS

A. Individual component Production/Manufacturer Testing and Labeling.

1. The equipment shall be UL listed, labeled, and approved for the application shown in the Contract Documents.
2. ETL (USA) each network systems infrastructure component. Third party testing, documentation and certification for performance compliance of each component with the UL, ANSI, TIA and EIA applicable Standards specified in the Contract Documents.

B. The complete system material, equipment, testing, installation, workmanship and installed performance shall comply with the Mandatory Requirements and the Guideline/Recommendation Requirements of the following latest published version, supplements, latest revision including Addendums and TSB. Both the mandatory and advisory criteria shall be included as Requirements of the Contract Documents:

1. TIA-526 Optical Power and loss measurements – multimode and single mode fiber.
2. ANSI/TIA/EIA-568C Commercial Building Telecommunications Standards.
3. ANSI/TIA/EIA-569B – Commercial Building Standards for Telecommunications Pathways.
4. ANSI/TIA/EIA-570A Residential Telecommunications Standard.
5. ANSI/TIA/EIA-598B Optical Fiber Cabling Color-Coding.
6. ANSI/TIA/EIA-606A Administrative Standard for Commercial Telecommunications Infrastructure.
7. ANSI/TIA/EJA-607 Commercial Buildings Grounding and Bonding Requirements for Tele- communications.
8. FCC – FYU/FT6.
9. ISO/IEC 11801
10. National Electrical Code (NEC) and California Electrical Code (CEC) including Articles 770 and 800 with ETL verified testing and local code jurisdictions.
11. NECA/NEIS, National Electrical Contractors Association, National Electrical Installation Standards:
    a. 301 – Standard for Installation and Testing for Fiber Optic.
    b. 568-Standard for Installing Building Telecommunications Bonding and Grounding.
    c. 607-Telecommunications
12. Manufacturer's recommendations for the respective equipment.

C. Network Performance

1. The entire completed Electronic Network Systems Infrastructure shall be tested and provide electronic data/network and telephone/voice multi-channel communications latest revisions, standards and addendums for the following protocols:
    a. IEEE 802.3/ETHERNET latest revisions.

2. Twisted pairs copper wire (100 meter path length unless indicated otherwise)

   a. 10Mbps 10Base-T, 100Mbps 100Base-Tx;
   b. 1000Mbps (1Gbps) 1000 Base-Tx;
   c. 10,000 Mbps (10Gbps) 10Gb Base-Tx.
   d. IEEE-802.3 for Power Over Ethernet (POE) and Power Over Ethernet-Plus (POE Plus).

3. Fiber optic, 550 meter communications pathway distance, OM4 standard multimode and OS2 single- mode.

   a. 10Mbps 10Base-F1, 100Mbps 100Base-FX,
   b. 1000Mbps 1000Base-Lx-Sx
   c. 10,000 Mbps (10Gbps) for fiber optics
   d. Single Mode path length performance increase Requirement to 3000 meters.

4. IEEE 802.5/TOKEN RING.
5. APPLETALK (Phone-net).
6. FDDI - Distributed data interface on fiber or copper wire, 100Mbps.
7. 100VG – Any LAN
8. TIA/EIA serial and Bi-directional RS-232 and RS-485, including Star-Hub repeaters.
9. ANSI - TPPMD 55Mbps, 155Mbps and 622Mbps Asynchronous Transfer Mode - ATM.

D. The Complete Telephone/Voice Infrastructure System shall be suitable for the telephone/voice analog and digital communications and VoIP protocols. The system shall be compatible with the telephone/voice equipment installed as part of the Contract.

E. Installation of All Infrastructure Equipment, Devices, Splices, Terminations, Cables, Outlets, etc. shall comply with Manufacturer's recommendations.

1.4 EQUIPMENT QUALIFICATIONS

A. Equipment

1. The Supplier of the equipment shall be the Factory Authorized Distributor and service facility for the brands of equipment and material provided.
2. Network systems infrastructure equipment and materials shall all be the product of one of the individual same Manufacturers as follows. Typical unless specifically described otherwise:

   Belden – 10GX Series; or CommScope-Systimax X10D Series; or AMP/Tyco NetConnect Series; or Ortronics/Legrand – NetClear Series; or Siemon – ConvergeIT Series.

B. Installation Certification

1. Work and material for cables, cable terminations, outlets and related components for infrastructure systems shall be performed by Certified Installers. The Installer shall be certified by the respective Product Manufacturers.

2. The Manufacturers of the indicated work and material shall provide an Installer education/training and certification program for the supplied products.
3. The Installers performing the Contract Work for the indicated products shall have attended and successfully completed each of the respective Manufacturer's installation training education programs for the specified products.
4. Submit six copies of the Manufacturer's Certifications for each installer performing the work. The submittal shall be approved by the Owner's Representative prior to initiating any related Contract Work.
5. Contract material installed and work performed by Installers not complying with these Requirements shall be removed. Removal of work and material not in compliance with these Requirements shall done at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions. New material and work required to replace the non-complying removed work and material shall be provided at the Contractor's expense, without any additional cost to the Contract and without any additional Contract completion due date extensions.

C. Extended Material and Performance Warranties

1. In addition to the Warranty Requirements described elsewhere in the Contract Documents, provide the following extended material and performance warranties. The warranty period shall be for not less than 15-years from the Contract Notice of Completion.
2. Warranty scope includes materials and performance for network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
3. Repair or replace the defective material with new material at the Project premise, to comply with the performance standards outlined in the Contract Documents during the warranty period.
4. Submit seven copies of proposed warranty statements, with Shop Drawing submittals.

1.5 ABBREVIATIONS

Abbreviation	Terminology
ACR	Attenuation to Cross Talk.
AHJ	Authority Having Jurisdiction.
Backbone	Circuit interconnections between MDF and IDF patch panel locations. dB
	Decibel.
dBm	Decibel referenced to a milliwatt.
Demarc	Demarcation location where operational control change occurs or ownership change occurs.
ft	Feet.
GHz	Gigahertz.
Gbps	Gigabits per second.
Horizontal Connection,	Circuit interconnections between and/or individual workstation outlet

Horizontal wiring ..... location to respective IDF or MDF equipment rack patch panel.
IDF..... Intermediate Distribution Frame (horizontal or vertical cross connect) for an individual building area/ floor.
km ..... Kilometer-lkm.
kPSI ..... 1000 pounds per square inch.
m ..... Meter = 39.37 inches.
Mbps ..... Megabits per second.
MDF ..... Main Distribution Frame (central/main cross connect) for multi-building site or for a single individual building.
MHz ..... Megahertz.
MIC..... Micrometer
mm ..... Millimeter = $l0^{-3}$ meter.
NEXT..... Near end cross talk.
nm ..... Nanometer = 10^{-9} meter.
pF ..... Picofarad = 10^{-12} farad.
Provide..... Furnish, install and connect.
RTDE..... Equipment rack mount fiber optic termination distribution enclosure, with fiber optic patch panel.
RMSE ..... Equipment rack mount fiber optic enclosure, splice only (without patch panel).
STP ..... Shielded individual twisted pairs copper wire.
ScTP ..... Shield Screened Twisted Pairs copper wire.
Trunking-Cable..... Individually insulated twisted pair copper wire cable, consisting of 24-pair or more of conductors inside a common cable jacket. Terminate and connect to common terminal-block location at each end of the trunking-cable.
um ..... Micrometer = 10^{-6} meter.

USE..... Universal Splice Enclosure.
UTP..... Unshielded twisted pairs copper wire.
VoIP..... Voice communications Over Internet Protocol.
WGNA..... . Wide Band Gigabit Networking Alliance.
Workstation or ..... Spaces remote from the MDF/IDF terminal Workstation location room/closet, where user equipment interacts and connects with the electronic systems infrastructure equipment connection outlet device.
WMIC..... Wall Mount fiber optic cable Interface Cabinet.

1.6 MATERIALS AND METHODS

A. Material and Labor not complying with the Contract Documents shall be removed by the Contractor from the Project Site. Material and labor complying the Contract Documents shall be provided.

B. All the cost to remove deficient work and material, provide work and material complying with the Contract Documents and the direct, indirect, incidental damages and Contract delays resulting from complying with these Requirements shall be the sole responsibility of the Contractor and shall be included in the bid price.

C. System Performance Requirements

1. The work, performance and type of materials provided as part of the Contract shall comply with the following ANSI/TIA/EIA-568C and related standards for all Electronics Network Systems Infrastructure work and materials described in the specifications and shown the Drawings:

   a. Computer/data network systems: Category-6
   b. Telephone/intercom voice systems: Category-6

2. The Electronic Network Systems Infrastructure system shall be based on “star-topology”; for MDF to IDF backbone connections and workstation outlet to MDF/IDF horizontal connections.

PART 2 - PRODUCTS

2.1 FIBER OPTICS CABLES

A. General

1. Operating temperature range - 20 degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
2. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled “Limited Combustible Cable” (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.

   a. Limited combustible “FHC-25/50” per UL-2424.
   b. NEC/CEC;CMP, additional listing/labeling where the install location is an environmental air plenum, fiber optic “FHC-25/50-CMP and/or OFNP/OFCP”.
   c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited- combustible.
   d. NFPA-5000; defines combustible material including wire and cable.
   e. NFPA-75 computer rooms and electronic equipment room.
   f. NFPA-13; spaces containing “limited combustible loading”.

3. Cables shall qualify as 100% recyclable materials disposal, RoHS Regulation complaint.
4. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics specified prior to and after the cable is installed. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cables shall be removed and replaced with fully functional cables at no additional cost to the Contract.
5. Cables shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with Specified Requirements. ANSI/TIA/EIA-568C

including related Standards, Amendments and TSB.

6. Each fiber shall be individually identified with factory color-coding or factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number, along with Agency listing identification.
7. Fiber optic cable shall be a product of the same Manufacturer, including portable patch cables.
8. Cables installed in raceways or conduits below grade, through in-grade manholes or pullboxes shall be rated for installation in water/wet locations.
9. Provide overall outer jacket enclosing all fibers inside jacket. Cables containing less than seven fiber strands shall be provided with a color coded outer jacket (red or orange).
10. Multimode (62.5/125)

    a. Fiber optic cables optical fibers, (62.5/125) graded index multimode optical glass fibers, 62.5 micron fiber core and 125 micron fiber cladding, 0.275 numerical aperture. Optical fibers shall be 100 kpsi proof tested, with maximum 0.7 micron flaw size for dual operation at 850nm and 1300nm wave lengths.
    b. Minimum bandwidth: @ 850nm - wave length 160MHz per km length @ 1300nm - wave length 500MHz per km length
    c. Maximum attenuation: @ 850nm-wave length 3.4 dB @ 1km length @ 1300nm-wave length 1.0 dB @ 1km length
    d. Laser-optimized "OM2" optical multi-mode standards.

11. Multimode (50/125)

    a. 50/125 fiber optic cables optical fibers, graded index multimode optical glass fibers, 50.0-micron fiber core and 125-micron fiber cladding, 0.2 numerical apertures. Optical fibers shall be 100 kPSI proof tested, with maximum 0.7 micron flaw size for dual operation at 850nm and 1300nm wave lengths.
    b. Minimum bandwidth:
    @ 850nm-wave length 3500Mhz per km length @ 1300nm-wave length500Mhz per km length
    c. Maximum attenuation:
    @ 850nm-wave length 3.0db @ 1km length @ 1300nm-wave length1.0db @ 1km length
    d. Laser-optimized "OM4" optical multi-mode standards.

12. Single mode:

a. Fiber optic cables optical fibers, (8.3/125) single mode optical glass fibers, 8.3-micron core fiber and 125-micron fiber cladding, 0.11 numerical apertures. Optical fibers shall be 100-kPSI proof tested, with maximum 0.7-micron flaw size. For operation at 1310nm and 1550nm wave lengths.
b. Maximum attenuation:
   @ 1310nm- wave length 0.5 dB @ 1km length
   @ 1550nm- wave length 0.4 dB @ 1km length

c. Maximum dispersion
@ 1310nm- wave length 2.8 ps/nm km length
@ 1550nm- wave length 18.0 ps/nm km length

d. Laser-optimized "OS1"/OS2" optical single mode standards.

B. Loose Tube Gel-filled Cables

1. Multiple, loose tube buffer tubes, gel-filled. Each buffer tube shall contain the same quantity of optical fibers, but not more than twelve optical fibers in each buffer tube.
2. Buffer tubes shall be cabled around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
3. Aramid yarn, non-optical, strength fibers shall extend continuously along the length of the cable.
4. The cable interstitial spaces shall be flooded to inhibit water migration, with non-flammable water blocking gel.
5. Each optical fiber shall be individually UV cured acrylate coated, 250-micron diameter coating over fiber cladding.
6. A seamless black polyethylene outer layer jacket shall envelope the entire cable.
7. The cable shall be fungus resistant, UV resistant, and moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/ pullboxes continuously flooded with water.

C. Indoor/Outdoor Cables

1. The cable shall be fungus resistant, UV resistant, moisture resistant for installation indoors with or without an enclosed raceway and outdoors in underground enclosed raceway/conduit and manholes/ pullboxes continuously flooded with water, and in conduits exposed to the sun.
2. Each optical fiber shall be primary coated with 500 micron uniform acrylate tight buffered and with elastomeric uniform 900-micron diameter tight buffered, secondary coating. Aramid yarn strength member elements shall be tensioned and symmetrically and uniformly distributed around the fibers, along the length of the cable.
3. An overall cable jacket uniformly extruded directly around and mechanically interlocked with the optical fibers/strength members. The extruded jacket shall form internal helical cusped ridges that interlock with the optical fibers and strength members. The interlocking jacket shall not allow cable fibers to move axially within the cable jacket.
4. Cables containing more than twenty-four optical fibers shall be constructed with sub-cable fiber bundles. Each sub-cable bundle shall contain equal quantities of optical fibers, with a separate PVC jacket around each sub-cable. Sub-cable and sub-cable jacket construction shall match the Overall Cable Requirements and Jacket Requirements.
5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

a. NEC – OFNR (Vertical Riser Type Locations) OFNP (UL FHC-25/50 LC Plenum Type Locations and locations where not continuously enclosed inside conduits for

entire cable length).

b. NEC – OFNG (Where continuously enclosed inside conduits for entire cable length).

D. Tight Buffered Cables

1. Each optical fiber shall be coated, 900-micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
2. Individual multiple optical fiber assemblies shall be symmetrically arranged around a central dielectric strength member. The central strength member shall be centered along the length of the cable.
3. A dielectric strength member shall surround the fiber assemblies.
4. An outer dielectric jacket shall envelope the entire cable.

5. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents. ETL tested and certified to comply with or exceed Specified Requirements.

a. NEC - OFNP (UL FHC-25/50 LC Plenum type locations and locations where not continuously enclosed inside conduits for entire cable length).

2.2 COPPER WIRE CABLES (TWISTED PAIRS)

A. General

1. Conductors shall be copper wire, individually insulated and color coded, with multiple conductors arrange in twisted pairs.
2. An overall non-conductive jacket shall encase the copper wires and any shielding (where shielding is specified) shall also be encased by the jacket.
3. Cables shall be UL listed, complying with NEC National Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements.

    a. NEC – MPP/CMP, FHC-25/50 (Plenum type locations and locations where not continuously enclosed inside conduit).
    b. NEC – MPR/CMR (Vertical riser type locations).
    c. ANSI/TIA/EIA-568C; including related Standards, Amendments and TSB.

4. Electronic network systems infrastructure cables that are not installed inside conduit raceways. Electronic network systems infrastructure cables that are installed in concealed spaces including plenums and non-plenums; access floors, ceiling spaces, walls, floor, etc., and/or installed without continuous raceways. The cable insulation and jacket shall be listed and labeled “limited combustible cable” (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.

    a. Limited combustible “FHC-25/50” per UL-2424.
    b. NEC/CEC;CMP, additional listing/labeling where the install location is

an environmental air plenum, copper wire “FHC-25/50-CMP”.

c. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited- combustible.
d. NFPA-5000; defines combustible material including wire and cable.
e. NFPA-75 computer rooms and electronic equipment room.
f. NFPA-13; spaces containing “limited combustible loading”.

5. Cables shall qualify as 100% recyclable materials disposal, RoHS regulations complaint.
6. Cables installed in air plenums, air-handling spaces and cables installed without raceway or conduit shall also be UL listed and labeled for installation in air plenums.
7. Cables installed in raceways or in conduits below grade, or through in-grade manholes and pullboxes, shall be rated for installation in water/wet locations.
8. The outer cable jacket shall be imprinted with date, Manufacturer’s model and catalog number and Agency (AHJ) listing identification.
9. Copper wire Electronic Network Systems Infrastructure cable shall be a product of the same Manufacturer, including portable patch cables.
10. The outer jacket of cables with less than nine pair of conductors shall be color-coded. The jacket color shall be different for each system type; multimedia; telephone/voice; computer/data network; and fiber cable jackets.
11. 300-volt RMS insulation material for each data conductor shall be the same material; shall be the same electrical characteristics and shall be the same dielectric constant, for all data conductors contained within the respective common cable jacket, along the entire installed length of the cable. Data cables employing differing insulation materials for individual data conductors contained within a common cable jacket are not acceptable and shall not be provided.
12. Propagation and “Skew” Rate

    a. Skew rate (nominal velocity of propagation delay) between any twisted pair in a combination of 4-twisted pair conductors grouped in the same cable, shall not exceed 35-nano seconds between any wire pair contained in the conductor group, and as required by the cable Category rating, over a cable length of 328-feet (100 meters), for all frequencies up to the cable maximum frequency rating.
    b. Nominal velocity of propagation, exceeding 70% of the speed of light.

13. Large capacity feeder cables and trunking-cables

    a. Copper wire cables with more than 24-twisted pairs of conductors shall be constructed with 25- pair binder groups of conductors. The cable binder groups shall be enclosed in colored binders and assembled to form a single cable. The twisted pair/binder groups shall be enclosed with multi-layer dielectric protective sheaths underneath a cable jacket enclosing the entire cable assembly. A corrugated metal 100% shield shall be provided under the cable jacket enclosing all conductors.
    b. Cables shall be wet location rated and listed for installation in conduit, where the conduit is in a wet environment and/or high-temperature environment, including:

    · Underground conduit.

- Inside manholes and pull boxes.
- Outdoor conduit exposed to weather and/or sunlight.

c. ANSI/TIA/EIA Category rating of cable assembly shall be Category-5E, trunking-cable.

B. Category-6 Computer/Data Enhanced Cables – [ScTP] [UTP]

1. Category-6 cables shall be tested and shall pass the ANSI/TIA/EIA Test recommendations for Category- 6.
2. Operation Characteristics:

a.	Wire size	23AWG solid copper (23AWG stranded copper for portable patch cables)
b.	Quantity of twisted pairs	As indicated but in no case less than 4-twisted pairs
c.	Impedance	100 OHM □ 15%, 1-500Mhz
d.	Maximum Signal Attenuation	2.1dB @ 1Mhz Per 328-feet 3.8dB @ 4Mhz (100 meters) 5.9dB @ 10Mhz 7.5dB @ 16Mhz 8.4dB @ 20Mhz 10.5dB @ 31.25Mhz 15.0dB @ 62.5Mhz 19.1dB @ 100Mhz 27.6dB @ 200Mhz 31.1dB @ 250Mhz 34.3dB @ 300Mhz 40.1dB @ 400Mhz 45.3dB @ 500Mhz
e.	Mutual Maximum Capacitance of Any Pair	4.4nF/100m
f.	Worst Pair "NEXT" Loss Per/328-feet (100 meters)	67.0dB @ 1Mhz 67.0dB 4hz 67.0dB @ 10Mhz 67.0dB @ 16Mhz 67.0dB @ 20Mhz 67.0dB @ 31.25Mhz 65.6dB @ 62.5Mhz 42.3dB @ 100Mhz 58.0dB @ 200Mhz 56.5dB @ 250Mhz 55.3dB @ 300Mhz 53.5dB @ 400Mhz 52.0dB @ 500Mhz

3. ScTP, all the wires in the cable shall be enclosed in a common, 100% metallic foil shield with copper "drain" wire, shield and drain wire located under the cable jacket.

2.3 FIBER OPTIC FIBER SPLICES

A. General

1. Fiber optic cable splices shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA–568C including related Standards, Amendments and TSB.
2. Fiber optic splices shall be the product of the same Manufacturer.

B. Mechanical Splice

1. Mechanically splice each fiber with a splice suitable for use with the type of fiber optic fibers. Re- enterable and reusable splice. Splice shall be recommended as compatible with the optical fibers by the Manufacturer. Splice shall not require the use of adhesives. Splice shall provide integral strain relief.
2. Performance Requirements after installation:

a. Operating temperature range minus 20-degrees centigrade through plus 60-degrees centigrade.
b. Loss variation over temperature range, 0.05dB or less at specified wave lengths.
c. Insertion loss, 0.3dB or less at specified cable wave lengths.
d. Reflection (return loss), -40dB at specified cable wavelengths.

C. Fusion Splicing

1. Fusion splicing shall be performed with equipment providing the following features:

a. Cleaving and cleaning optical fiber.
b. Integral splice optimization verification system with local injection and detection.
c. Projection screen optics and fiber core alignment system.
d. Fiber cleaning/stripping.
e. Cleaning fiber ends and fusing of fiber together with an electric arc.

2. Fusion splice insertion loss as measured at the completion of the splice shall be less than 0.1dB at specified cable wave lengths.

2.4 FIBER OPTIC FIBER CONNECTORS AND INTERCONNECTION COUPLERS

A. General

1. The connectors and interconnection couplers shall be compatible, maintain the same Performance Category rating and be compatible with the corresponding fiber optic cable type attached to the connectors.
2. Fiber optic cable connectors and interconnection couplers shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Connectors and couplers shall comply with ANSI/TIA/EIA-568C, related Standards, Amendments, TSB, and TIA/EIA-Fiber Optic Connector Intermateability Standard (FOCIS) documentation.
3. Fiber optic connectors and couplers shall be the product of the same Manufacturer.
4. Shall be UL listed and comply with UL94V-0.
5. Color code connectors for fiber optic cables to match the respective fiber optic strand/jacket color.

B. Fiber Optic Fiber Connectors

1. LC – Small Form Factor (SFF) termination connector

a. Ceramic oxide 1.25mm ferrule. Mechanical durability not less than 500-mating cycles. Insertion loss of mated connector shall be less than 0.3dB at specified wavelengths.
b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide

duct cover cap for each connector.

c. Locking type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

2. ST type bayonet termination connector

a. Ceramic aluminum oxide 2.5mm ferrule, multi-cure ultra violet or heat cured epoxy bonded, for multimode or single mode to match cable fiber. Insertion loss of each mated connector shall be less than 0.3dB at specified wavelengths.

b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match the connector installation application. Provide dust cover cap for each connector.

c. Locking type, to automatically align fiber cable and prevent accidental pullout.

3. SC – Square/Subscriber termination connector

a. Ceramic oxide 2.5mm ferrule.

Insertion loss of mated connectors shall be less than 0.3dB at specified wavelength.

b. Strain relief boot, long boot type unless indicated otherwise, short or angled boot type to match connector installation application. Provide dust cover cap for each connector.

c. Push-pull snap and lock type to automatically align mating fibers in the fiber cable and prevent accidental rotation and pullout.

4. "FSD" fixed shroud duplex type termination connector

C. FIBER OPTIC FIBER INTERCONNECTION COUPLERS

1. Interconnection couplers shall be “like-to-like” compatible, and shall provide "plug-in" coupling of two fiber optic cable connectors terminated with fiber optic fibers front-to-rear "in-line" together. The coupler shall provide interlocking, automatic optical self-alignment of two mating fiber optic connectors.
2. The centerline to centerline spacing of the interconnection couplers shall allow removal and insertion of portable patch cords, fiber cable connectors for both “single” and “duplex” type fiber adapter connectors without interfering with adjacent connectors.
3. Patch panel mounted interconnections couplers shall be factory pre-mounted to a modular nominal 0.09- inch thick metal panel, couplers aligned and anchored on the plate.

a. The metal panel shall be predrilled for Standard EIA mounting in high-density 19-inch wide metal patch panel frames.

4. Interconnection couplers in workstation outlets shall be installed in outlet boxes with cover plates.
5. Provide removable dust caps for the front side of each coupler.

2.5 COPPER WIRE OUTLET CONNECTORS

A. General

1. Connectors shall comply with FCC part-68 Subpart F for gold plating.
2. Connectors shall be UL listed and shall comply with UL94V-0.
3. Provide a removable blank dust cover for each plug-in outlet insert. The dust cover shall protect the insert from contamination until a workstation or patch cord is "plugged" into the outlet.
4. Copper wire outlet connectors shall be color coded to distinguish telephone/voice separately from computer/data. The outlet cover plate shall be engraved to identify telephone/voice, computer/data and other infrastructure outlets separately.
5. Copper wire outlet connectors shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
6. Copper wire outlet connectors shall be the product of the same Manufacturer.

B. Universal Outlet Connector (for twisted pair Copper Wire Premise/Workstation Wiring and copper wire patch panels).

1. General

a. Connections for twisted pairs copper conductors shall provide a universal outlet connector between the building premise copper wire, and plug-in workstation locations. Patch panel/ equipment plug-in connectors. The connector components shall assemble with "snap-in" spring loaded retainers to prevent dislocation during insertion or removal of external plug-in devices.

b. The contacts shall be gold plated with a 250 insertion/withdrawal cycle rating.

c. Unless specifically noted otherwise the universal outlet connector shall comply with ANSI/TIA/ EIA-568C; related Standards, Amendments and TSB.

d. Operational characteristics shall match or exceed and shall be compatible with the respective twisted pair's cable.

e. A metal ground shield with EMI/RFI metal ground clip shall be provided where shielded cable is connected to the universal outlet connector for each universal outlet connector assembly.

f. Each universal outlet connector shall consist of three major components.

1) Universal edge connector assembly.
2) Plug-in adapter inserts.
3) Connector housing.

g. Provide snap-in blank removable insert covers for connector installed without plug-in adapter inserts.

2. Universal edge connector:

a. Insulated assembly shall connect to the premise copper wire. The connectors shall be multiple plug type connector contacts, one contact (total of eight contacts) for each individual premise wire connection interconnected to the individual wire terminations.
b. Connector shall provide insertion of individual insulated copper wire, gas tight, 110-style punch down/displacement termination, for 22-26 AWG insulated premise wire.
c. The edge connector assembly shall provide termination of eight separate wire conductors, twisted or untwisted pairs, solid or stranded, shielded or unshielded, with color codes and numbered identification of each contact. Integral cable/conductor strain relief to prevent pullout of terminated premise wire conductors.

3. Plug-in adapter inserts:

a. Plug-in adapter inserts shall be internally factory connected to the universal edge connector assembly to adapt the universal connector to the specific outlet type configuration (i.e. "RJ" style computer/data, telephone/voice, (multimedia) modular jacks, etc.).
b. Inserts shall be certified for shielded or unshielded wire, to match premise wire type connected to the universal edge connector.
c. Inserts shall provide correct pin-to-pin connections, electrical and mechanical matching characteristics for the specific equipment connected to the respective outlet.
d. Inserts for different infrastructures shall be color coded with different colors from each other, for system identifications.
e. Plug-in adapter insert type:

1) Computer/data network systems:

a) ANSI/TIA/EIA-568C, female modular jack 8-position/contact "RJ-45" style.

2) Telephone/intercom voice systems:

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45” style.

3) Multimedia audio/video TV (baseband only):

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
b) Each multimedia audio/video outlet location provides a Balun to match the circuit impedance of the premise wiring to the multimedia outlet signal type.

4) Intrusion detection/access control systems:

a) ANSI/TIA/EIA-568C female modular jack 8-position/contact RJ-45 style.
b) Each intrusion detection system outlet location provides a Balun to match the circuit impedance of the premise wiring to

the intrusion system outlet signal type.

4. Connector housing:

a. Connector housing shall contain the universal edge connector assembly and the plug-in adapter inserts in a rigid assembly. Connector housing shall provide integral cable strain relief for the premise wiring connection.
b. The connector housing shall mount to a metal panel, metal device cover plate or plastic device cover plate with spring loaded snap-in retainers. Nominal depth of connector housing behind the mounting panel and/or device cover plate shall not exceed 1.625-inch including Premise Wiring Termination Depth Requirements.

C. Coaxial Cable Connectors

1. General

a. BNC type connectors, for coaxial cable premise/workstation wiring and coaxial cable patch panel equipment.
b. Unless noted otherwise, the BNC connectors shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB.
c. Brass body and male contact. Beryllium copper or bronze female contact. Bayonet coupling with threaded or cam-locking mating connection.

2. Operational characteristics shall match or exceed and shall be compatible with the respective coaxial cable. 75-OHM, operational frequency range 0-4500MHz.

2.6 FIBER OPTIC FIBER DISTRIBUTION ENCLOSURES

A. General

1. Fiber optic fiber distribution enclosures shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA–568C including related Standards, Amendments and TSB.
2. Fiber optic fiber distribution enclosures shall be the product of the same Manufacturer.

B. Equipment Rack Mount Fiber Optic Termination Distribution Enclosure - RTDE

1. The RTDE enclosure shall mount in an EIA standard 19-inch wide enclosed or open frame equipment rack assembly. The RTDE enclosure shall be metal, painted finish, Manufacturers standard color.

2. The RTDE shall provide the following self-contained functions internal to the RTDE assembly.

a. Fiber cable termination.

b. Fiber cable "pig-tail" splicing.
c. Fiber cable patch panel.
d. Fiber cable management, training and strain relief.
e. Individual fiber and patching port identification numbers, color-coding of incoming trunk and out-going distribution fiber ports.
f. Plug-in fiber optic interconnection couplers for port to port patching with portable fiber optic patch cords.

3. Fiber splice drawers:

a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open, and removable for easy access. Each drawer shall contain two fiber optic splice trays with tray holders.
b. Drawers shall stack vertically one above the other in the RTDE and allow sufficient slack in all fiber cables for removal of the drawer and splice trays.
c. Provide one sliding drawer and two splice tray assemblies for each group (twenty-four individual fibers or fewer fibers per group) of fiber optic fibers terminated in the equipment rack, but in no case provide not fewer than two sliding drawers with splice tray assemblies in each RTDE.

4. Fiber cable patch panel

a. Metal panel shall provide a patch port for each fiber consisting of metal panel mounted fiber optic interconnection couplers for each fiber optic fiber indicated to be terminated at the RTDE.
b. The fiber optic fiber interconnection coupler shall be provided to match and be compatible with the fiber cable connectors. Quantity shall match quantity of terminated fibers, unless indicated otherwise on the equipment rack schedules.
c. Nominal panel thickness 0.09 inches.
d. Provide a minimum of sixteen unused spaces for additional couplers in the patch panel.

5. Nominal height of the RTDE shall not be exceeded, as follows:

Quantity of Patch Ports	Quantity of Splice Drawers	Nominal Height
24	2	11-inches
48	2	11-inches
72	3	14-inches
144	6	28-inches

C. Equipment Rack Mount Fiber Optic, Splice only (for use only where fiber patch panel is not required) enclosure
- RMSE

1. The RMSE enclosure shall mount in an EIA standard 19 inch wide enclosed or open frame rack assembly. The enclosure shall be metal, painted finish, Manufacturer's standard color.

2. The RMSE shall provide the following self-contained functions internal to the RMSE assembly:

   a. Fiber cable splicing for "thru splicing" of fiber optic cables where the cables do not terminate in the equipment rack.
   b. Fiber cable management, training and strain relief.

3. Fiber splice drawers

   a. Horizontal sliding metal drawers adjustable to approximately 30-degree angle when fully open and removable for easy access. Each drawer shall contain two fiber optic splice trays with splice tray holders.
   b. Drawers shall stack vertically one above the other in the RMSE and allow sufficient slack in all fiber cables for removal of the drawers and splice trays.
   c. Provide one sliding drawer and two fiber optic splice tray assemblies for each group (24- individual fibers or fewer fibers per group) for fibers optic fiber routed through but not terminated in the equipment rack, but in any condition provide not fewer than two sliding drawers with splice tray assemblies in each RMSE.

4. Nominal height of the RMSE shall not be exceeded, as follows:

Quantity of Thru Splices	Quantity of Splice Drawers	Nominal Height
24	2	4-inches
48	2	4-inches
72	4	8-inches
96	4	8-inches

2.7 COPPER WIRE PATCH PANELS

A. General

1. Copper wire patch panels shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
2. Copper wire patch panels shall be the product of the same Manufacturer.

B. Equipment Rack Mounted Patch Panel

1. Standard EIA 19-inch wide metal panel, Manufacturers standard color. Pre-punched for copper wire outlet connectors. Panel shall mount on an EIA standard 19 inch wide enclosed or open frame equipment rack assembly. Nominal 24-copper wire outlet connectors in a horizontal row, quantity of rows as required for total quantity of connectors. Provide not less than two spare empty rows for future copper wire outlet connectors.

2. The patch panel shall provide the following self-contained functions.

a. Copper wire cable termination including conductor/ shield termination and strain relief.
b. Plug-in copper wire outlet connectors for port to port patching with copper wire portable patch cords.

3. Patch panel height shall be based on the quantity of copper wire outlet connectors described plus the specified space for future outlets and shall not exceed the following dimension height:

Outlet Quantity	Nominal Patch Panel Height
1-24	3.5 inches
25-48	7 inches
49-72	10.5 inches
73-96	14 inches

4. Horizontally mounted, cable support metal bracket shall be provided for each 24-outlet/connector groupings. The brackets shall be bolted to the equipment rack located at the backside of the patch panel; the brackets shall support and provide strain relief for each incoming copper wire cable connecting to the patch panel.
5. The copper wire connector installed in the patch panel shall be the same configuration, Manufacturer and type as the corresponding copper wire connector provided in the remote workstation outlet locations connecting to the respective patch panel outlet, unless indicated otherwise.
6. Each multimedia, audio/video/TV multimedia and intrusion detection/access control outlet. Provide a Balun, to match the circuit impedance of the premise wiring and to the outlet signal type.

2.8 TELEPHONE/VOICE TERMINAL BLOCKS

A. General

1. Terminal blocks Type 110, shall consist of wiring blocks, connecting blocks, direct wire/patch cord cross connection and designation strips. Arrange in unitized, modular, vertical mounting sections, for telephone/voice.
2. Completely 100% front accessible for cross connections, terminating conductors, training, and fanning of cables. Rear access for any reason shall not be permitted.
3. Telephone/voice terminal blocks shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. Telephone terminal blocks and connections performance shall comply with ANSI/TIA/EIA-568C and related Standards, Addendums and TSB and shall comply with and be listed under UL 1863. Category rating shall match the cables connecting to the patch panel.
4. The telephone/voice terminal blocks shall provide cross connection of telephone/voice four pair premise copper wiring from telephone/voice handset outlets to multiple copper wire telephone/voice feeder cables and external free standing telephone equipment.
5. Each full height vertical section terminal block assembly shall terminate a minimum of 900 pairs (including specified spares for future construction phases) of telephone/voice conductors, plus associated cross connection wiring and patch cords in a nominal 20-inches wide by 90-inches high space. Provide multiple vertical sections of terminal block assemblies adjacent to each other, total quantity as required for quantity of telephone/voice conductor pairs and telephone/voice feeder cable pairs shown on the

Drawings and Requirements, plus specified spares.

6. Each telephone/voice terminal block vertical section assembly shall provide 15% or 100 (whichever is the larger quantity) of spare unused conductor pair terminals for future telephone/voice connections.
7. Provide a common ground bus in each terminal block section with a minimum of six ground conductor termination positions, #10AWG through #6AWG.
8. Terminal blocks shall be the product of the same Manufacturer.

B. Wiring Blocks

1. One piece molded, die-electric thermoplastic blocks. The wiring block shall support and secure all the components of the terminal block assembly, and provide cable/conductor training and organization.
2. Fire retardant complying with UL 94V-0.
3. Standoff type support legs for mounting to backboard with pre-drilled anchor holes.
4. Non-conductive electrically quiet front assembly.
5. Horizontal index strip rows, for termination of not less than 25-conductor pairs on each row. Color coded and marked in groups of four pairs or five pairs to match connecting cables.
6. Removable retainers at the ends of each horizontal connecting block index strip row, shall support cross connect wires at corner turns.
7. Distribution rings shall retain cross connect wire horizontal routing between terminations.
8. A full width, horizontal trough between each 100 pair wiring block shall provide a path for patch cord training and retention.

C. Connecting Blocks

1. Connecting blocks shall provide gas tight conductor electrical connections with conductor insulation displacement punch down slots, for insertion onto the telephone/voice wiring block index strips.
2. Connecting blocks shall electrically connect one-to-one between each conductor terminated at the wiring block index strips, and each cross connect/patch cord conductor terminated/connected to the opposite front side of the connecting block.
3. Both sides of the connecting blocks shall terminate telephone/voice UTP 22-26AWG stranded or solid copper wire individually insulated conductors. The front side of the connecting blocks shall also provide "plug-in" connections for portable patch cords, 110 style "plug-in" connectors.
4. Connection blocks shall be 4-pair insulated copper conductor type.
5. Provide insulated, removable termination caps for each connector block.
6. Connector blocks shall be marked to indicate tip and ring conductors and to indicate polarization.

D. Designation Strips

1. Designation strips shall provide retention of interchangeable labels. The labels shall show circuit identification of each terminated conductor pair.
2. The designation strips shall mount on the center and outside positions of the wiring block.

E. Telephone/Voice Cross Connection

1. The cross circuit connection between incoming and outgoing feeder cables and telephone voice outlet wiring shall be provided in the terminal block assembly.
2. The cross connection wiring shall terminate incoming and outgoing circuit conductors between respective connecting blocks.

    a. Direct connect cross connection shall provide internally wired one-to-one conductor twisted pair cross connection. Provide cross connection of each 4-pair telephone/voice outlet cable to corresponding 4-pairs of the telephone/voice feeder cable and cross connection of feeder to feeder cables, as applicable.
    b. Patch panel cross connect, 110-terminal connector style, plug-in. Provide two twisted pair, 110- connector type portable patch cords.
    c. Prewired 50 pin-amphenol connectors:

        1) Provide factory prewired 50-pin amphenol connectors for connection from telephone/ voice terminal blocks to the telephone switch equipment and Telephone Utility Company outside telephone service lines.
        2) Provide 50-pair ANSI/TIA/EIA-568C and related Standards, Addendums and TSB cables, connected to 50-pin amphenol connectors at one end (telephone equipment connection) and connected to the respective telephone/voice terminal wiring blocks at the other end.
        3) The 50 pin amphenol connectors shall group together and be positioned at the top of the respective terminal block section near the ceiling.
        4) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.

5) The amphenol connector/cable assemblies shall connect to and extend the telephone/ voice outlet premise wiring from telephone/ voice terminal block to the telephone switch equipment. The amphenol connector/cable assembly shall connect to and extend the Telephone Utility Company outside telephone service lines to the telephone switch equipment.

d. Prewired "RJ" style modular jacks

    1) Provide factory prewired eight position/contact plug-in "RJ" style jacks for patch panel portable patch cord cross connects, located on the front side of the terminal blocks.
    2) The pin-to-pin conductor assignments shall conform to the Telephone Switch Manufacturer's Requirements.

2.9 EQUIPMENT RACK

A. General

1. An equipment grounding bus, nominal 19-inches long, UL labeled as a ground terminal bus, shall be provided on each equipment rack. The ground bus shall be bolted to the rack main metal frame member with 1-inch standoff non-insulating bolts. Provide a minimum of ten drilled and taped bolt holes in the ground bus with ground lug bolts, for

connection of equipment grounding conductors to the ground bus, size to accept ground conductors #14-#4AWG.

2. Vertically mounted, cable management metal rings (aluminum or stainless steel) shall be provided full height, continuously along the front and rear of each vertical rail of the equipment rack. The rings shall be bolted to the equipment rack. The rings shall train and dress portable patch cords connecting between outlet connectors located in the equipment rack or in adjacent equipment racks.
3. Provide horizontal cable management panels with multiple cable training rings on each panel (not less than five rings for each panel). Management panels (for up to 24-outlet grouping) nominal 19-inches wide by 1.75-inches high by 3-inches deep and/or (for up to 48-outlet groupings) 3.5-inches high by 3 inches deep, for EIA rack installation. Rings shall provide horizontal routing and support by grouping portable patch cords connecting between patch ports in the same equipment rack or adjacent racks. Patch cords shall be grouped and bundled with “Velcro” tie wraps and shall not overlap patch fields or rack mounted equipment. The cable management panels shall be installed on both the front and rear of the equipment racks mounted both above and below horizontally between groups of patch ports as follows:

    a. One cable management panel (front and rear of rack) for each group of forty-eight or less copper wire outlets for patch ports.
    b. One cable management panel (front and rear of rack) for each group of 48-fiber optic outlet patch ports.

4. The entire rack assembly including any support arms shall comply with Seismic Earthquake Requirements for install location structural standards.

    a. The assembly shall provide support for the weight of the equipment installed on the rack, but in no case less than 500-pounds of equipment, plus the weight of the rack and connecting cables. A
    2.0 time’s safety factor shall be included in the equipment rack assembly structural design.

5. Provide Plug Strip Surge Protection Device with RF Suppresser (SPD) and Power Distribution Units (PDU). Horizontal strip, mounted in each equipment rack. Each unit shall contain not less than six “plug-in” on the rear of the SPD and not less than two plug-in on the front of the SPD protected outlet plugs.

    a. Provide two SPD/PDU units in each equipment rack, to supply “dual-corded” equipment.

6. Provide pre-drilled mounting holes the entire length of equipment vertical mounting frames, EIA-310D- 19 inch (nominal) wide standard spacing for indicated equipment. Racks shall provide 17.75-inches (nominal) equipment horizontal mounting space between vertical rails.
7. Provide all floor standing equipment racks with wall bracket support arms extending from the stationary portion of the rack to adjacent wall. Provide "dual-rail arm" cable “runway tray”, horizontally from each equipment rack, to the wall directly behind the equipment rack

    a. The tray shall extend from and bolt to the top of the equipment rack “fixed” top rail.
    b. The tray side rail arms shall be a minimum of 6-inches deep, with "ladder" type rungs spanning horizontally between the side rail arms. The rail arms shall be

parallel with each other. The rail- to-rail arm spacing shall be the same as the equipment rack width.

8. The rungs shall be spaced not more than 6-inches on center between the side rails, along the length of the side rail arms. The rungs shall have a minimum cable-bearing surface of not less than 0.75-inches, lengthwise along the tray.

a. The runway tray shall support a minimum of 200 pounds per linear foot live conductor/cable loading, with not more than 0.25-inches deflection at mid-span.

b. Provide a continuous horizontal support “C” channel along the wall behind the equipment racks and bolt the dual-rail arm cable runway tray to the channel at the wall. The channel elevation on the wall above the finish floor shall support the runway tray horizontally (0.2-inches), from the equipment rack to the wall.

c. Equipment racks shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.

d. The wall mounted horizontal support channel shall be securely through bolt to wall structural member, a minimum of 16-inches on center. The horizontal support channel shall extend a minimum of 6-inches past each side of the runway tray. Support channels as manufactured by Unistrut-P1001C Series; or B-Line; or Kindorf.

9. Provide a copper ground – bus for equipment bonding, in each equipment rack.

10. Equipment racks shall be Manufacturer’s standard rust inhibitor primer. Manufacturer’s standard color finish paint over primer, unless noted otherwise.

B. Swing Gate Open Equipment Rack Style:

1. Combination wall and floor mounted rack frame nominal 78-inches of usable equipment vertical space for mounting equipment into the rack. The equipment mounting portion of the rack shall be a hinged gate frame assembly. The rack shall provide access to the rear of the installed equipment, the wall behind the rack assembly and wall mounted terminal blocks, when hinged open.

2. The gate assembly shall hinge open not less than 90 degrees from the closed (normal position) on a fixed frame combination floor/wall mounted support structure. A positive latching mechanism shall lock the gate in the fully open and fully closed positions. The rack construction shall allow opening the swing gate, with the installed equipment depth, without obstruction. The fixed stationary portion of the swing gate rack assembly shall be supported from both the fixed floor bracket and wall located behind the rack with adjustable length “dual rail arm” wall brackets. The arms shall provide field adjustment (approximately 24-inches) of the equipment rack spacing from the wall behind the rack. Provide a minimum of two support arms for each swing gate equipment rack.

3. The rack assembly shall be constructed of extruded metal; aluminum gold irradiates finish, or hot dip galvanized steel. Bolted or welded assembly. Hardware shall be stainless steel.

4. Provide steel caster rolling wheel support on the bottom rail of the moveable swing gate frame. The wheel shall provide additional support, but not the main support, of the moving gate assembly and rack mounted equipment along the floor travel "outside arc" of the gate in the open or closed position. The vertical height of the wheel assembly shall be adjustable □3 inches.
5. Swing gate equipment racks as manufactured by B-Line; or Saunders; or Hendry.

C. Floor Standing Equipment Rack Fully Metal Enclosed Style:

1. Floor mounted self-supporting rack, nominal 80-inches high by 24-inches deep, by 24-inches wide. Internal bolted or welded hot dip galvanized steel or gold irradiate finish aluminum, support frame. Metal enclosed with screw attached removable metal panels. Manufacturer's standard finish color.
2. The front and rear of the rack shall be a full height hinged door, opening not less than 90 degrees from the closed position. The doors shall be readily removable with positive latching mechanism to lock to the doors in fully open or fully closed positions. Doors shall be pad-lockable. Rack shall provide a minimum of 4-inches of clear space between front door and internal mounting face for rack mounted

equipment. Smoke/grey impact resistant, tamper resistant see-through windows in the doors, front and rear. Hardware shall be stainless steel.
3. Provide six 120-volt 60Hz AC motor direct drive air ventilation, "muffin" style, nominal 4-inches square, exhaust air fans. Flush mount fans in the top of each equipment rack. The fans shall be low speed, low noise type with wire guards to prevent accidental contact with the fan blades. The fan motor shall be high impedance, self-protecting type motors. Provide "SO" cord with plug caps to connect from the fans to the 120 volt plug-strip in the equipment rack.
4. Provide cooling air intake louver with a removable 19-inches wide air filter and air filter holder, mounted in the bottom of the rack front nominal 6-inches high.
5. Floor standing metal enclosed equipment racks as manufactured by Stantron; or BUD; or equal.

D. Fixed Position Floor Standing Open Frame Equipment Racks:

1. Floor mounted self-supporting rack, nominal 78-inches of usable mounting frame height for equipment.
2. Bolted or welded hot dip galvanized steel or gold irradiate finish aluminum support frame. Hardware shall be stainless steel.
3. Open frame rack construction, fixed, non-swing gate.

   a. “Two-post” style for equipment racks not designated as containing UPS equipment nor server equipment.
   b. “Four-post” style for equipment racks designated as containing UPS equipment and/or server equipment.

4. Open frame equipment racks as manufactured by B-Line; or Saunders; or Hendry.

E. Floor Standing Modular Frame Equipment Racks

1. Provide a modular frame equipment rack, bolt together modular rack system with all

accessories for a completely assembled equipment rack unit. The rack system, when configured for specific equipment, shall support and organize network servers, keyboards, printers, tape drive units, RAID units, CRT's, UPS units, telephone switching equipment, desk top work spaces, etc.

2. Nominal overall dimensions 31-inches deep by 72-inches wide by 84-inches high. Left/right or right/left orientation as indicated on Drawings. Minimum weight capacity of the entire rack assembly shall be 1500 pounds.
3. Manufacturer's standard finish painting, crème white color for metal surfaces. Horizontal flat support surfaces shall be post-formed, laminate top finish, white color.
4. "8L-01/8L-02" vertical support upright assemblies; shall be slotted the full height to "hook-on", lock in and support adjustable height (in 1-inch increments), modular components, with integral floor support "feet". Open back frame - "LF31". Minimum of three vertical support and open back frames in each complete assembly.
5. Provide vertical (on upright supports) and horizontal (on modular "hook-on" components) wire management raceways integral to the assembly.
6. Network server configuration - equipment rack unit:

    a. "LE28" computer tower "roll-out" horizontal floor shelf; nominal 47-inches wide by 24-inches deep. Shelf shall pull out on "ball-bearing" rails, with 23-inch extension for access to computers. Provide one tower shelf for rack unit. Minimum weight capacity 750 pounds. Mount at floor.
    b. "LE25"-computer tower horizontal shelf with □12 inch end panels and two shelf support brackets; nominal 47-inches wide by 22-inches deep, fixed mounted. Provide one tower shelf for rack unit. Minimum weight capacity 500 pounds. Mounting height □30-inches.

    c. "LB32" horizontal work surface; nominal 24-inches wide by 27-inches deep. Provide one work surface assembly for each rack unit. Minimum weight capacity 300 pounds. Install on left or right side of rack as shown on Drawings. Mounting height □28-inches.
    d. LF10/LF11/W162 - General equipment shelf; nominal 72-inches wide by 15-inches high by 16.7 inches deep, with two horizontal shelf surfaces, full width of rack, □ 10-inches nominal vertical height between shelves and five vertical shelf dividers. Minimum weight capacity 300 pounds. Provide one general equipment shelf assembly for each rack unit. Mount at top of rack.
    e. "LA-09" - Keyboard platform. Retractable keyboard platform with auxiliary mouse pad and up- down 15 degree adjustable tilt and adjustable 360 degree swivel. Nominal 23-inches wide by 11 inches deep. Provide three keyboard platforms for each rack unit. Install below, upper tower computer shelf and work surface.

F. Plug Strip Surge Protection Device (SPD).

1. General

    a. Self-contained unit combining plug-in receptacle strip and SPD. Rated 20-amp, nominal 120- volt +10%, 60Hz, AC, 2400 watts full continuous load. Internal 20-amp resettable overload protection circuit breaker. Red illuminated on-off switch. 9-foot, 12AWG three-conductor grounded, high abuse heavy duty jacketed AC, line cord with NEMA 5-20P cap.
    b. Multi-outlet receptacles, suitable for use with the following types of

plug in loads; data processing equipment, audio/video equipment, test instruments, medical equipment, photo graphic equipment and "switching type" power supplies.

c. Protected 120-volt outlets shall be NEMA 5-15R 15-amp, or 20-amp NEMA 5-20R AC 60Hz receptacles, as applicable for connected equipment loads. Provide not less than eight protected outlet plugs on each unit. Each individual or group of two receptacles (duplex) shall be connected to separate protected load isolated filter banks.

d. Each duplex shall be isolated from the other output receptacles, minimum isolation of 25dB at 1MHz line to line, line to neutral, line to ground and neutral to ground.

e. Non-blocking plug-in locations/orientation, for plug-in self-contained "power-brick", equipment power supplies.

f. As manufactured by Liebert; or TRIPP LITE.

2. Operation

Self-contained RFI and EMF shielded housing with mounting slots for temporary mounting of the unit. Protected outlet receptacles shall supply over current protected and filtered, electrical line voltage power to the connected equipment. Line noise RFI and EMI interference filtering suppression, surge protection device and spike protection shall occur in all three modes of operation line to ground, line to neutral and neutral to ground rated as follows:

a. 13,000 amp, 210 joules (watt-seconds) peak withstands capacity.

b. Surge response time less than 5-nano seconds.

c. 140-volt AC RMS initiate spikes suppression 330 volt maximum let through.

d. RFI and EMI Suppression-Provide spectrum analysis test dB attenuation reports showing RFI filtering over specified frequencies.

e. Diagnostic indicator lights located on the SPD housing shall provide alarm alert for each of the following conditions:

1) Loss of AC power.
2) Damage, malfunction in the SPD circuits.
3) Improper AC electrical outlet wiring.

f. Standards Testing, Listing and Certification Compliance:

1) IEEE 587 A and B compliance.
2) UL 1449 surge suppressers.
3) UL 1363 temporary power taps.
4) UL 1283 electromagnetic interference filters.

3. Rack Mounted SPD

a. SPD units installed in equipment racks shall comply with all of the same Performance Requirements including as follows.

1) EIA/TIA – Equipment rack horizontal mount style (19-inches or 24-inches as applicable).
2) Minimum of two front mounted outlets and not less than six rear mounted

outlets.

3) Position in each equipment rack as directed by Owner's Representative.
4) Provide two SPD units in each equipment rack, for "dual-corded" network equipment.

G. Power Distribution Unit (PDU)

1. General

a. Self-contained unit combining main circuit breaker, multiple plug-in individual circuit breaker branch protection load receptacles, PDU metering status monitoring and network communication. All PDU components self-contained in a NEMA-1 metal enclosure.
b. Non-blocking plug-in locations oriented for plug-in self-contained "power-brick" equipment supplies.
c. Standards Testing

1) UL 60950-1 Information Technology Equipment.
2) CAN/CSA-C22.2 No.60950-1-03 Information Technology Equipment.
3) FCC, Title 47, Part 15 Subpart B for Class B operation as defined by ANSI Standard C63.4.
4) ROHS Complaint.
5) ISTA Procedure 1A and 2A.

d. Provide two PDU units in each equipment rack, to supply two SPD units in each equipment rack.
e. Shall be a product of the same Manufacturer as the SPD unit. As manufactured by Liebert; or TRIPP LITE.

2. System Description

a. Remote monitoring and/or control capabilities for power distribution at each load/equipment rack level. For data/network equipment line voltage plug-in and SPD line voltage plug-in electrical distribution.
b. PDU shall meter and monitor electrical attributes of an individual Rack PDU, including real-time remote and local display of monitoring of aggregate and branch electrical parameters (status, thresholds, alarms) including voltage, ampere, and kW. Rack equipment PDU and Branch load monitoring and control.
c. Self-contained metering and communications

1) Local display ampere-meter demand load meter to monitor plug-in demand load and total PDU load.

2) Digital Fast Ethernet LAN RJ-45 communications port for Ethernet SNMP and IP network monitoring of electrical status. Multi-user site-wide software license, compatible with PC-computer and IP-WEB HTTP protocols.
3) Provide network array-interface for connection of multiple PDU units positioned in the same location.

d. Nine foot input power (heavy duty high abuse) cord with appropriate conductors and input NEMA plug-in connection. Provide input

overload protection with Hydraulic-Magnetic main input circuit breaker. Provide load output NEMA plug-in branch connection with overload circuit breaker protection for each load receptacle.

e. Equipment rack mounting horizontal position form factor.

3. Electrical Power ratings shall be as follows and as additionally indicated on Drawings. Refer to Drawings for twist-lock verses straight-blade configurations.

   a. Single main input circuit breaker 30 amp, 208/120 volt 3-phase 5-wire “WYE” grounded 60Hz AC.
   b. Branch load circuit breakers with a single plug-in receptacles for each load circuit breaker. Balance loads on each circuit phase.

      1) Three 20 amp 1-pole circuit breaker and three NEMA 5-20R receptacles. Also provide matching caps.
      2) One 30-amp 2-pole circuit breaker and one NEMA 14-30R receptacle. Also provide matching cap.
      3) Additional circuits and receptacles as indicated on Drawings.

4. Provide heavy duty high abuse flexible copper wire 300-volt insolated 15-feet long jacketed electrical cord. Connect from PDU to wall-outlet receptacle with same electrical rating as PDU. Rated for PDU voltages and amperes.
5. PDU units installed in equipment racks shall comply with all of the same Performance Requirements including:

   a. EIA/TIA – equipment rack horizontal mount style (19-inches or 24-inches) as applicable.
   b. Position in each equipment rack as directed by Owner’s Representative.

6. Provide two Category-6A 4-pair UTP 15-foot long portable patch cable connects, PDU to respective network patch panel port.

2.10 WALL MOUNT FIBER OPTIC CABLE INTERFACE CABINET (WMIC)

A. General

1. Metal (14 gauge) enclosure, with full height hinged metal door. Door shall be pad-lockable. Nominal size 12-inches deep by 18-inches wide by 36-inches high. Enclosure shall mount directly on the wall.
2. WMIC shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
3. Interface cabinets shall be the product of the same Manufacturer.

B. The WMIC shall provide the following self-contained functions internal to the WMIC enclosure.

1. Fiber cable splicing for "through splicing" of non-UL listed fiber optic cables, where the cables do not terminate in the building.

2. Fiber cable management, training and strain relief.
3. Transition from non-UL flame spread listed fiber optic cable, to UL flame spread listed fiber optic cables where the cables terminate in the building.

C. Cable routing rings shall organize optic fibers in a 360 degree loop inside the WMIC housing and provide cable strain relief.

D. Fiber Optic Splice Trays

1. Provide fiber optic cable splice trays.
2. Tray holders shall provide mounting and support for each splice tray.
3. Provide two splice trays for each group (24 or less fibers per group) fiber optic fibers routed through the WMIC, but in no case provide not less than four splice trays in the WMIC.

2.11 UNIVERSAL SPLICE ENCLOSURES - USE

A. General

1. The universal splice enclosure shall provide splicing for multiple cables containing multiple, network copper wire conductors or fiber optic fibers.
2. The enclosure with the connecting cables installed shall be water tight, continuously submersible in up to 10-feet depth of water without leaking water into the enclosure interior.
3. The enclosure with splices shall be completely re-enterable to allow access to the interior splices, adding cables, and removing cables, without compromising the water tight integrity of the enclosure.
4. The universal splice enclosure assembly shall be UL listed.
5. The USE shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
6. USE shall be the product of the same Manufacturer.

B. Fiber Optic Splices

1. Provide fiber optic splice trays inside the USE. Each splice tray shall provide space for up to 12 splices in lieu of 24-splices on the tray.
2. A splice tray holder shall rigidly anchor splice trays inside the USE, with sufficient slack cable, to allow individual removal of each splice tray.
3. Provide one splice tray for each 12-fibers passing through the USE, but not less than eight splice trays in the use enclosure.

C. Copper Wire Splices

2.12 SPLICE TRAY FIBER OPTIC FIBERS

A. General

1. Trays shall be suitable for installation in USE, WMIC, RMSE and RTDE enclosures.
2. The trays shall be the product of the same Manufacturer as the respective enclosures.
3. Splice trays shall be UL listed, complying with national Electrical Code, ETL tested and

certified to comply with or exceed specified Requirements, ANSI/ TIA/EIA-568C including related Standards, Amendments and TSB.

B. Splice Trays

1. A metal or non-metal splice tray shall provide space for up to 24-splices of individual fiber cable single mode and multimode optical fibers. The trays shall provide individual splice holder inserts for each splice to adapt the tray for mechanical or fusion splices, with or without splice sleeves.
2. The tray shall incorporate integral fiber tie down clamps, fiber routing rings, provide strain relief and two full 360-degree fiber loops around the tray perimeter with sufficient slack fiber for removal of the tray for access and splicing of the fiber cable. The tray shall insure the minimum bending radius of the optical fibers is not violated.
3. Provide a removable clear plastic tray top cover for each tray, to protect and isolate the fibers.

2.13 WORK STATION OUTLETS

A. General

1. Engrave outlet cover plates with the port number corresponding to the port number at the respective terminal block, patch panel, or head-end equipment.
2. The outlet cover plates shall be factory pre-punched and formed to accommodate the installed outlet connector with attachment screws.
3. Workstation outlets shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.
4. Workstation outlets shall be the product of the same Manufacturer.

B. Computer/Data Workstation Copper wire Outlets

1. The outlets shall be the same configuration and type as the corresponding connector provided in the copper wire patch panel outlet, unless noted otherwise.
2. ANSI/TIA/EIA-568C, and related Standards, Addendums and TSB.
3. The copper wire outlet connectors for twisted pair wire connections in computer workstation outlets shall be universal outlet connector RJ-45 type.

C. Telephone/Voice Handset Twisted Pair Wire Connection Work Station Outlets

1. The copper wire outlet connectors provided in telephone/voice handset outlets, shall be universal outlet connector type, unless noted otherwise, ANSI/ TIA/EIA-568C and related Standards, Addendums and TSB.

a. RJ-45 type
b. RJ-11 type

D. Fiber Optic Workstation Outlets

1. The fiber optic outlet connectors workstation outlets shall be fiber optic fiber interconnection couplers, installed in universal outlet connectors. Provide one coupler for each fiber connecting to the outlet, but in no case less than the following for each outlet and as shown on the Drawing:

a. Computer workstation data network two couplers and fiber connectors.
b. Data network server - four couplers and fiber connectors.

2. The universal outlet connector housing and cover plates shall be the same as copper wire outlet connectors, except with adapters for fiber optic interconnection couplers, for the fiber optic fibers plug- in connectors.
3. The centerline-to-centerline spacing of the inter-connection couplers shall provide for "plug-in" insertion of “single or duplex” fiber connectors.
4. Color-code and identify the "in"-receiving and "out"-transmitting position for each interconnection coupler.

E. Outlet Boxes

1. General for Low Voltage Outlets Requirements

a. Shall be UL approved and labeled for Life-Safety Appliances.
b. UL listed and label for low voltage CEC/NEC class-2 wiring and devices.
c. Shall be adjustable to fit into the wall/ceiling and attach into the wall/ceiling thickness at each install location.
d. Provide cable “Strain-Relief” attachment and “Sharp-Edge” protection for each outlet cable connections.

2. Wall mounted

a. Flush or surface wall mounted outlet box and size as indicated on the Drawings, but in no case less than 4.69-inches by 4.69-inches by 2.125-inches deep.
b. Two gang wide extension ring for outlet box to extend outlet flush with finish surface, or as noted on the Drawings.
c. Two gang wide cover plate, or as noted on the Drawings.

3. Pedestal Mounted "Poke-Thru".

a. Shall combine a computer/data and a telephone/ voice copper wire universal outlet connector in a duplex outlet in the pedestal/poke-thru outlet.

4. Inside flush floor boxes and other locations where indicated in the Contract Documents.

5. Low Voltage Outlets in Fire rated walls and ceilings

a. Provide metal outlets for low voltage devices installed (recessed into) in fire rated walls or fire rated ceilings.

b. Provide metal outlet box enclosed type, for each outlet location. Provide UL labeled and listed “Fire-Wrap” complete coverage protection on the exterior of each outlet box. The combined outlet box and “Fire-Wrap” protection shall be equal or greater than the respective wall or ceiling fire-rating location.

6. Low Voltage Outlets in Non-Fire Rated walls and ceilings

a. Outlets for low voltage devices installed (recessed into) walls or ceilings, only where the wall/ ceiling is not fire-rated.
b. Provide the following for each outlet location

1) Metal outlet box, enclosed type. All locations where one or more conduit(s) are required to connect to the outlet, then only metal outlet box shall be provided.
2) Or device mounting bracket with trim ring, without (backless) enclosed outlet box. Do not use bracket-trim/ring configuration where conduit connection to the outlet with conduit is required, provide metal outlet boxes. Shall provide attachment for low voltage device(s), cover plates and low voltage wire strain relief.

7. Low Voltage outlet installed into accessible suspended ceiling with removable ceiling panels.

a. Support outlet independent of ceiling supports and ceiling.
b. Provide a minimum of three independent hanger wires for each outlet. Attach hanger wires to building structure above ceiling and to outlet.

8. Low Voltage Outlets in existing walls and existing ceilings

a. Outlets installed (recessed into) existing walls or (recessed into) existing ceilings. Cut and patch to match existing surfaces for outlet installation.
b. Provide “cut-in” retrofit mounting-attachment into existing ceiling/wall construction. Shall be UL rated for retrofit into “old-work”.
c. Provide the following for each outlet location,

1) Metal outlet box, enclosed type. Required for all Fire rated construction locations. Also permitted for non-Fire rated construction locations.
2) Or device mounting bracket with trim ring. Permitted only for non-Fire rated construction locations only where no conduit connection to the outlet is required. Do not use in Fire rated construction locations. Do not use where conduit connection to out-let is required.

d. Where the existing wall/ceiling existing fire rating is indeterminate, Contractor shall assume the existing fire rating is not less than 2-hours. Provide metal outlet box and Fire-Wrap for each recessed outlet box.

F. Multi-outlet Raceway Work Station Outlets

1. Copper wire outlet:

a. Where copper wire connection is indicated for the workstation outlet, provide one universal outlet connector for each outlet.
b. Each universal outlet connector shall be single connector housing type.
c. Provide a rectangular cutout and metal device plate in the raceway sized to Outlet Manufacturer's recommendations. The workstation copper wire outlet shall mount a modular faceplate kit with outlet bezel and faceplate sized to match the workstation outlet.
d. Offset the location of outlets for electronic network systems 6-inches in the raceway from other outlets, do not "stack" outlets one above the other in the raceway.

2. Fiber optic outlet:

G. Combination Outlets

1. Infrastructure outlet connectors shown at the same location for either wall box outlet locations and floor box outlets locations.
2. The outlet connectors shall be installed in a common outlet box with a common cover plate in the respective wall location or floor location.
3. In infrastructure patch panels install the connectors in the respective patch panels.

2.14 PORTABLE PATCH CORDS

A. General

1. Provide portable patch cords for all copper wire and fiber optic cable infrastructure outlets:

a. For interconnecting electronic network equipment to electronic network workstation outlets.
b. For interconnecting equipment rack patch panel outlet patch locations with each other.
c. For interconnecting patch panel outlets equipment rack mounted hubs, switches, routers, telephone equipment, A/V equipment, access control and intrusion detection equipment etc.

2. Patch cords shall be factory assembled tested and certified with factory terminated plugs at each end. Field terminated portable patch cords shall not be permitted. Terminated plugs shall incorporate integral bending radius limiting molded “boots” and strain relief. Patch cord assemblies shall be rated for "heavy duty", “high-abuse” service.
3. Patch cords shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements. ANSI/EIA/T1A-568C, related Standards, Addendums and TSB.

a. NEC - OFNG/OFN for fiber optic portable patch cords.
b. NEC - MPP/CMP/CMR/CMG/MPG for copper wire twisted pair portable patch cords.

c. NEC - CATV for coaxial cable portable patch cords.

4. Patch cords which are not installed shall be delivered to the Owner in cardboard boxes. The patch cords shall be neatly bundled and tied together. Mark each box with quantity and type of cords contained in the box.
5. Patch cords shall comply with the same Cable Communication Performance Requirements, Protocol Requirements and Testing Requirements as the respective infrastructure cables and outlets to which the patch cords are intended to be connected (plug-in). Patch cords shall be the product of the same Manufacturer.
6. The outer jacket of each portable patch cord shall be imprinted with date, Manufacturer's model and catalog number and AHJ listing identification.
7. Provide a permanent, visible, factory applied identification number on each end of each patch cord. The identification number shall be the same on each end. However, the numbers shall increase sequentially on each patch cord and shall be unique and not duplicated on other patch cords. Permanently apply the identification numbers on the cable jacket or connectors.

B. Twisted Pairs, Copper Wire Portable Patch Cords

1. Twisted Pairs portable patch cords, general:

a. "Male" eight-position modular "RJ" male style jacks install on each end of the patch cord cable. The jack shall be provided with a rear "fin" to prevent the plug tab from snagging when pulled backwards through adjacent wiring.
RJ-45 style "male" jack, typical unless noted otherwise.
b. Patch cord cable shall be UTP and ANSI/EIA-Category rating, shall match respective premise wiring, 4-pair twisted, stranded copper individually insulated wires, thermoplastic jacket over all the wires and shield.
c. Connectors shall comply with FCC 68.5 and Part 68 Subpart F.
d. Connectors UL listed and shall comply with UL-94V-O.
e. Contacts gold plated with not less than a 750 insertion/withdraw cycle rating.

2. Portable patch cord quantities and lengths for connecting port-to-port equipment rack patch panels

a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire equipment workstation outlet patch port in the equipment rack patch panels. One-to-one straight through pin-to-pin wiring. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for copper wire computer workstation outlets in the equipment rack patch panels. Cable jacket color shall be blue:
b. Provide the following lengths of copper wire patch cables for copper wire equipment rack patch panel outlets.

1) 2-feet long - 10% of total quantity
2) 4-feet long - 30% of total quantity
3) 6-feet long - 30% of total quantity
4) 10-feet long - 20% of total quantity

5) 16-feet long - 10% of total quantity

3. Portable patch cord quantities and lengths - for connection from equipment workstations to equipment workstation outlets, located remote from equipment racks.
   a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire work- station outlet located remote from the equipment rack patch panels. Provide additional spare patch cords, quantity equal to 15% of the total quantity of patch cords provided for each copper- wire computer workstation outlets. Cable jacket color shall be blue:
      1) Infrastructure network outlet segments the pin-to-pin patch cord wiring configuration and jacks shall be compatible with the equipment protocol communications interface, and the respective workstation outlet.
      2) Provide the following lengths of copper wire patch cables for equipment copper wire infrastructure network workstation outlets. The patch cords shall provide internal cross-over wiring to conform the pin-to-pin connections required between the equipment workstation outlet and the equipment protocol communications interface installed in the respective work-station equipment: 8-feet long - 30% of total quantity15-feet long - 70% of total quantity

4. Portable patch cord quantities and lengths for connection from electronic equipment rack patch panel ports to equipment installed in equipment racks, such as HUB's, servers, switches, router, telephone and concentrator equipment ports. Cable jacket color shall be white.

   a. Patch cord quantity: Provide one complete patch cord assembly for each copper wire outlet port located in electronic equipment. Provide additional spare patch cords, quantity equal to 25% of the total quantity of the equipment rack equipment ports.

      1) The pin-to-pin patch cord wiring configuration and jacks shall be compatible with the respective equipment and patch panel outlets as applicable.

   b. Provide the following lengths of copper wire patch cables for outlet ports located in electronic equipment installed in equipment racks. The patch cords shall provide quantity of conductors, wiring shall conform the pin-to-pin connectors and jack/ connectors to the ports in the equipment mounted in the equipment racks.

      1) 4-feet long - 15% of total quantity
      2) 6-feet long - 30% of total quantity
      3) 10-feet long - 35% of total quantity
      4) 16-feet long - 20% of total quantity

5. Portable patch cord quantities and lengths for connection of equipment requiring customized pin-to-pin wiring configurations and/or customized port connector configurations. Cable jacket color shall be tan.

   a. Patch cord quantity: Provide one complete patch cord assembly for each outlet

port install as part of the Contract and not identified in any other patch cord descriptions. The patch cords shall be customized and configured to comply with the respective Manufacturers recommendations.

b. Provide one patch cord for each port-to-port connection length as required for actual installation condition.

1) Provide 100% spare but not less than one spare patch cord for each custom configuration.

C. Telephone/Voice Copper Wire Portable Patch Cords-110 style

1. 110 style jacks for plugging into the 110 style connecting blocks located in the telephone/voice terminal blocks.
2. Patch cords shall be UTP 4-pair twisted, 24AWG stranded copper individually insulated wires with a thermoplastic jacket over all the wires. Cable shall be ANSI/TIA/EIA-568C.
3. Patch cord quantity and length - telephone/voice terminal block:

a. Provide one complete patch cord assembly for each copper wire telephone/voice outlet connecting to the telephone/voice terminal block. Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided for telephone/voice 110 patch cords.

b. Provide the following lengths of copper wire patch cables for telephone/ voice 110 style connecting block portable patch cords.

1) 3-feet long - 25% of total
2) 5-feet long - 50% of total
3) 15-feet long - 25% of total

D. Coaxial Cable Portable Patch Cords

1. BNC type connectors on each end of each patch cord. Shall be compatible with patch panel outlets, workstation outlets and respective equipment rack electronic equipment.
2. Patch cord quantity: Provide two complete patch cord assemblies for each coaxial cable outlet.

a. One patch cord for workstation outlet located remote from the equipment rack patch panel, 15- feet long each patch cord.
b. One patch cord for equipment rack (IDF/MDF) patch panel each outlet location, 10-feet long each patch cord.
c. Provide 15% additional spare patch cords of each patch cord length.

E. Fiber Optic Portable Patch Cords

1. General

a. Provide fiber optic fiber connectors installed on each fiber end of the patch cord cable. The fiber optic portable patch cord shall be “single” with one fiber strand type, for each patch cable. The connector shall be mechanically and optical compatible with the respective connecting patch panel couplers and network work equipment couplers.

b. The entire patch cord assembly total insertion loss shall be less than 1.0dB at the specified operating wavelengths.
c. Operating temperature range 30-degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.
d. Each fiber shall be individually identified with factory color-coding and factory imprinted label. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number, along with agency listing identification. The cable jacket color shall be yellow.
e. All fiber optic patch cord cable shall be a product of the same Manufacturer.
f. Optical fiber shall be coated, 900 micron diameter uniform coating, with uniform tight buffering over the coating, uniform dielectric strength member surrounding the buffering coating and an overall jacket around each optical fiber assembly.
g. A dielectric strength member shall surround the fiber assemblies.
h. An outer dielectric jacket shall envelope the entire cable.
i. The cable shall be UL listed and comply with NEC and NFPA Requirements for each installation location shown in the Contract Documents.
j. Patch cord quantity and length
    1) Patch cord quantity: Provide one complete patch cord assembly for each fiber optic patch panel outlet in the equipment rack.
    2) Provide one complete patch cord assembly for each computer workstation fiber optic outlet remote from the patch panel.
    3) Provide additional spare patch cords, quantity equal to 25% of the total quantity of patch cords provided.
k. Provide the following quantities and lengths of fiber optic patch cords.
    1) 3-feet long - 20% of total
    2) 6-feet long - 35% of total
    3) 10-feet long - 30% of total
    4) 20-feet long - 15% of total

2. Multimode patch cords

    a. Patch cord cable shall be fiber optic cable with equal or better characteristics as the premise fiber optic cables.

2.15 CIRCUIT PROTECTORS

A. General

1. The circuit protectors shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/TIA/EIA-568C including related Standards, Amendments and TSB.

B. Circuit Protectors

1. Cables containing non-dielectric electrical conducting components entering from the exterior of the building shall be provided with individual circuit protectors combining both

lightning circuit protection and SPD circuit protection on each circuit conducting component, as required in CEC Articles 770 and 800.

2. Install circuit protectors in the respective backboard/equipment rack where copper wire conductors terminate, connect each protector to room/closet ground bus equipment with #10AWG green insulated bond/ground copper conductors.

PART 3 - EXECUTION

3.1 NETWORK CABLE TESTING AND COMMISSIONING (ADDITIONAL REQUIREMENTS)

A. General

1. In addition to the testing recommended in ANSI/TIA/ EIA-568C and related Standards, Amendments and TSB. End-to-End test 100% of all individual optical fiber, individual copper wire conductors, each outlet and each connector in all terminated and unterminated cables, portable patch cord, outlets and patch panels provided in the Contract, shall be tested after installation as a complete channel pathway installation, splicing outlets and termination is completed, including the following end-to-end tests on each installed individual circuit; Each circuit wire and fiber map and length
    a. Each circuit insertion Loss
    b. Each circuit NEXT (Pair-to-Pair) Loss
    c. Each circuit NEXT Loss (Power Sum) PS
    d. Each circuit ELFEXT Loss (Pair-to-Pair)
    e. Each circuit ELFEXT Loss (Power Sum) PS
    f. Each circuit return Loss (RL)
    g. Each circuit propagation delay Each circuit propagation delay-skew

2. The test equipment and (Tester) shall comply with the Accuracy Requirements for Field Testers as defined in the ANSI/EIA/TIA Standards for the specific cable type. The Tester including the appropriate interface adapter shall meet the Specified Accuracy Requirements. The Tester shall be within the calibration period recommended by the Vendor in order to achieve the Vendor-specified measurement accuracy. The Tester shall be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor.

3. The Pass or Fail condition for the channel pathway link-under-test is determined by the results of the required individual tests (ANSI/EIA/TIA) Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass. A Pass or Fail result for each parameter is determined by comparing the measured values with the ANSI/EIA/ TIA test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field test. The Field Test Equipment Manufacturer shall provide documentation as an aid to interpret results marked with asterisks.

4. Provide all test equipment, Certified Testing Personnel, and setups. Shall comply with ANSI/EIA/TIA and Equipment Manufacturer’s recommendations and standards of practice.

5. Provide six copies of all test reports, bound in three ring binders. Provide three digital CD/DVD ROM copies. Organize test reports into rows-and-columns spread-sheet format, with data common groupings by IDF and NDF location. Submit to Owner's Representative.

6. The Contractor shall repair or replace equipment, cables, outlets, connectors, splices, terminations, etc. identified during testing as not complying with the Contract Documents, without additional cost to the Contract. Retest all replaced or repaired components at Contractor's expense.

B. Twisted Pair Copper Wire Testing

1. Channel insertion loss (dB).
2. Channel near-end cross-talk NEXT loss (dB).
3. Channel equal-level far-end cross-talk ELFEXT (dB).
4. Channel return loss (dB).
5. Channel power sum PSACR (dB).
6. Channel propagation delay, propagation speed, and delay skew.
7. Channel wire map and circuit length.
8. Channel ring-out test for continuity and correct point-to-point matching terminals.
9. Channel DC resistance and capacitance.
10. Channel attenuation-to-cross-talk ratio ACR.

C. Coaxial Cable Testing

1. Channel full specified frequency spectrum attenuation insertion loss (dB).
2. Channel wire mapping, ring-out and circuit length.
3. Channel propagation delay and propagation speed.
4. Channel impedance and continuity for center conductor and shields.

D. Fiber Optic Cable Testing, Optical Testing for Each Specified Wave-Lengths for Both laser and LED sources.

1. Channel link insertion losses (dB) OLTS
2. Channel loop-back attenuation (dB).
3. Channel signature Optical Time Domain Reflectometer – OTDR, for installation characterization testing (event and attenuation resolution dead zone at specified wave lengths, shall be less than 10-feet).
4. Channel continuity and correct point-to-point matching terminals.
5. Channel propagation delay and propagation speed.
6. Channel fiber optic mapping, circuit length, and tracing.

3.2 FIBER OPTIC CABLE TYPE

A. General

1. Cables shown as fiber optic type shall comply with the following installation locations.
2. Provide matching compatible outlets and terminate all fiber optic cables into matching fiber optic connectors.
3. Fiber optic cable installed in indoor locations without enclosed raceway or conduit.

a. Provide non-metallic, flexible corrugated continuous inner duct-raceway and

install fiber optic cable in the innerduct.

b. Innerduct shall be heavy duty, plenum-rated, Limited-Combustible (LC) type UL FHC – 25/50, orange color. Support innerduct 36-inches on center, independent of ceiling supports and independent of other equipment supports.

c. Innerduct size shall be selected to insure percentage-fill with fiber optic cables shall not exceed 30%, but in no case less than 1.25-inch diameter innerduct.

B. Provide loose tube gel filled or indoor/outdoor type fiber optic cable for any of the following installation location conditions.

1. Inter building (between buildings)
2. In a conduit or raceway located underground below grade.
3. In an exposed outdoor conduit or raceway not located underground or below grade.
4. Do not install loose tube gel filled type fiber optic cable inside a building or exposed on a building without providing Rigid Steel (RGS) conduit raceway for the loose tube gel filled fiber optic cable along the entire length of the cable inside the building or on the building.

C. Provide tight buffered or indoor/outdoor type fiber optic cable for any of the following installation location conditions.

1. Intra-building (inside a building) where raceway continuously encloses the cable and the raceway is not located underground, below grade.
2. In an exposed outdoor conduit or raceway not located underground or below grade.

D. Provide plenum rated type fiber optic cable for any of the following installation location conditions in building spaces.

1. Any building space air plenum (supply or return) when a conduit or enclosing raceway is not provided for the entire cable length. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC- 25/50.
2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in a building. Additionally, Cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.
   a.
   b. Limited–Combustible (LC) UL FHC-25/50 plenum rated cable.
   c. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.

E. Optical Fiber Quantity:

1. The minimum fiber quantities in each fiber optic cable shall be as follows, but in no case less than indicated on the Drawings.

2. Between main IDF (SUB-MDF) in separate buildings and the MDF main terminal rack fiber optic patch bay for the entire site/campus.

   a. Twenty-four optical fibers, multimode plus six optical fibers, single mode.

3. Between satellite IDF terminal rack fiber optic patch bays and the main terminal rack IDF (sub-MDF) patch bay located in the same building.

    a. Twenty-Four optical fibers, multimode plus six optical fibers, single mode.

4. Between a terminal rack patch bays (IDF or MDF):

    a. To an individual workstation outlet located inside the same building - two multimode optical fibers, (typical only for locations where fiber is specifically shown on the Drawings for the specific work station outlet).
    b. To each network file server outlet location whether or not shown on the Drawings, four optical fiber, and multimode.

5. Between a terminal rack-patch bay and individual multimedia network (television/video/audio) workstation outlets and/or intrusion/access program display devices located inside the same building - two optical fibers, multimode.
6. Other locations as indicated on the Drawings or described in the Contract Documents.

3.3 COPPER WIRE CABLE TYPE

A. General

1. Cables shown as copper wire type shall comply with the following installation conditions, unless noted otherwise on the Drawings.
2. Provide matching compatible outlets and terminate all copper wire cables into matching copper wire connectors.

B. Cable Types and Quantities - Cable types and quantities shall be as follows unless specifically noted other-wise on the Drawings. The following minimum type and quantity of copper wire cables from each individual workstation/device outlet, to the respective terminal equipment patch panel/bay, (unless specifically noted otherwise), but in no case less than what is shown on the Drawings and in no case less than one 4-pair cable to each outlet “Jack” position:

1. Two Category-6A, UTP 4-pair cable:

    a. Each network workstation outlet location.
    b. Each network “wireless-access-point” outlet location.

2. One Category-6A UTP 4-pair cable, for each telephone handset (instrument) workstation outlet location.
3. Trunking-Cables shall be Category-5E.
    a. 100-pair between buildings main IDF (SUB-MDF) and campus main MDF.
    b. 50-pair inside building between SUB-IDF to buildings main IDF (SUB-MDF).
4. Other locations as indicated on the Drawings or described in Contract Documents.

C. Provide plenum rated copper wire cable for any of the following installation location conditions in building spaces.

1. Any air plenum (supply or return) when a conduit or enclosed raceway is not provided for the entire cable length. Additionally, cables shall be rated Limited-Combustible (LC)

type UL FHC-25/50.

2. All building space locations where the cable is installed without a conduit or the cable is not fully enclosed in a raceway along the entire cable length in the building. Additionally, cables shall be rated Limited-Combustible (LC) type UL FHC-25/50.
3. Building spaces and/or cavities that are 100% fully protected with fire sprinklers, including fire sprinklers located above in ceiling cavities and fire sprinklers located below in access floor cavities. Cables installed in these locations shall be rated with one or more of the following additional characteristics.

    a. Limited–Combustible (LC) UL FHC-25/50 plenum rated cable.
    b. Or plenum rated cable without the UL FHC-25/50 Limited-Combustible (LC) rating.

D. OSP Insulated Copper Wire Cables

1. Outside – Plant (OSP) CEC/NEC rated, UL listed, labeled and approved insulated copper wire cable assemblies. Moisture barrier resistant and UV resistant cable jacket. Non-flammable, water blocking, non-conductive gel internally filled infrastructure cable assembly.
2. Provide rated insulated copper wire OSP type cable for any of the following copper wire infrastructure cable install locations.

    a. In underground conduit or in conduit under the building.
    b. In conduit exterior to the building, or in conduit exposed outdoor on the building.
    c. Outdoor aerial with aerial messenger wire cable carrier.

3. Except for aerial install locations, install all OSP cable in continuous conduit pathways, end-to-end.

3.4 CABLE INSTALLATION

A. General

1. Cables connecting to equipment racks and terminal blocks shall be installed with not less than 6-feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.
2. Cables in terminal closets and terminal rooms shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12-inches on center mounted onto the plywood along the entire length of all cables.
3. Provide separate routing paths on plywood backboards for fiber optic cables, computer data and copper wire cables and telephone/voice copper wire cables and multimedia, audio/video, TV cables. Provide separate routing paths on plywood backboards for shielded copper wire cables and unshielded copper wire cables.
4. Cables shall be routed parallel to floors and walls. Do not route cables diagonally on backboards.

5. Spare cable slack

    a. Provide 25-feet of cable slack where unterminated cables are specified at terminal backboards.
    b. Provide a minimum of 18-inches of slack cable in each workstation outlet box and

outlet locations.

c. Provide 10-feet of cable slack in ceiling above each work station outlet.
d. Provide 24-inches of slack in each cable at patch panel locations.
e. Coil and "Velcro" wrap slack cable.

6. Provide “horizontal wiring” cables installed from individual equipment locations and workstation out- lets to respective MDF/IDF terminal closet/room patch panel. Cables shall be continuous without cutting or splices.
7. Provide “backbone” cables installed from each IDF location to respective MDF/Sub-MDF location terminal closet/room patch panels. Cables shall be continuous without cutting or splices.

B. Cable Pulling Lubrication

1. Cable pulling lubricants shall be specifically approved by the Cable Manufacturer. The following lubricants shall be used where approved by the Cable Manufacturer.

a. Slip X -300, American Colloid Co.
b. Bishop #45, Bishop Electric.
c. MacLube CA51, MacProducts.
d. Minerallac H2B,- Minerallac Electric.
e. Winter grade #7437-PC, General Machine Products.
f. Gel-lube 7/5, Cable associates.
g. Polywater, A, C, G - American Polywater.

2. Lubricants shall be continuously applied as cable enters raceway.

C. Cable Installation:

1. Do not pull conductors until factory test reports have been submitted and reviewed.
2. Minimum bending radius of fiber optic cables shall not be less than the following. Maximum pulling tension shall not exceed the following. In no case shall the Manufacturer's recommendations be violated.

Cable Type	Cable Fiber Quantity	Minimum Bend Radius	Maximum Pulling Tension
Loose Tube	2-84	9 inches	600 pounds
Loose Tube	86-192	10 inches	600 pounds
Tight Buffered	2-12	5 inches	400 pounds
Tight Buffered	14-24	7 inches	600 pounds
Tight Buffered	26-28	11 inches	1100 pounds
Tight Buffered	48-72	12 inches	1200 pounds

3. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate Manufacturer's recommendations.
4. Cables installed in manholes and pullboxes on terminal backboards shall be installed on wall mounted cable support racks.
5. Provide a full 360-degree loop of cable around manhole and pullbox interiors.
6. The attachment of pulling devices directly to the cables shall be with individual split mesh basket grips. Direct connection for pulling cables to cable fibers and copper wires

shall not occur. Securely tape cable ends to prevent moisture or pulling compound from penetrating cable.

7. The attachment of the pulling device to the cable basket grips shall be made through a swivel connector.
8. The Contractor shall ensure that the cables are fed straight into the raceway taking care to avoid short bends, sharp edges and cable "cross-overs".
9. All lashings used for temporary bunching of the individual cables shall be removed before the cables enter the raceway.
10. Cables shall be "pulled through" or pulled from a "center of run pull" without splices or terminations and minimize cable rolling tension. Lead-out the cables at all manholes, pullboxes and conduits taking care to feed them in again by hand for the next portion of the cable run.
11. For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves etc. shall be used to insure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space, shall be provided in all situations, to insure the minimum possible cable side-wall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
12. Cable lengths over 50 feet shall be machine pulled not hand pulled into and through all raceways. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.
13. Cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to reel). Keep pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pull-hole during this operation. Cables shall be pulled directly from cable reels.
14. Cables shall be trained or racked in trenches, vaults, manholes and pull boxes with consideration given for the minimum specified bending radius of the cable and the possibility of cable movements due to load cycling. The cables shall be racked and supported in such a manner that adequate space is allowed for splicing and the cables shall always be fanned out from the duct or conduit so as not to cross other ducts, conduits or cables. To prevent damage from falling objects or personnel entering the manhole the cables shall not pass directly under the manhole opening.
15. Cable shall be supported in manholes, pull boxes and vaults a minimum of 18-inch on center with cable racks. Provide hot dip galvanized, T-slot racks and support arms. Secure cables to racks with porcelain supports for each cable on the racks. Loosely lash cables to racks. Splices shall be directly supported, on racks. Do not install cables more than one feeder on the same rack hook.
16. Cables shall be routed the long way around manhole, pull-hole, etc. with not less than a full 360-degree loop around the perimeter walls unless noted otherwise.
17. Existing conductors shall be protected at all times when Contract work occurs in the same area, including but not limited to pullboxes, vaults manholes, cable trenches etc. Provide temporary electrical insulating blankets and barriers over existing conductors to reduce the possibility of accidental mechanical damage to existing conductors.
18. Where cable tray is provided, all cables shall be routed and trained on the cable tray. The cables shall enter the cable tray and route along the tray prior to entering any equipment racks or computer works station outlets.

19. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200-feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull.
20. Bends shall not be made in cable splices or terminations.
21. The portions of cables installed without raceways or cable tray supports shall be installed with metal “J- hook” cable supports.

    a. The “J-hooks” shall provide multi-tiered “J” shaped hooks, with wide flat cable support base (0.5 inch wide minimum) and smooth rounded corners. Specifically designed for copper wire and fiber optic infrastructure cable support as manufactured by Erico Inc.
    b. The individual “J-hook” attachment to the building structure shall be metal, “beam clamp”, “hanger rod”, clevis hanger styles as applicable for each attachment location.
    c. Install “J-hooks” not more than 48-inches on center along the entire cable length and within 6 inches of each cable change in direction. Locations of “J-Hooks” and tension of cables shall insure between 4-inches and 6-inches of cable sag between adjacent hooks. Secure cables to “J- hooks” with re-enterable cable tie wraps. “J-hook” supported cables, bundle cables together with re-enterable tie wraps not less than 12 inches on center along the entire cable length.
    d. Each J-hook shall not support more than 12 individual cables. Provide multiple “tiered” J-hooks for additional cable quantities at each location.
    e. “Bridle rings” shall NOT be used to support cables.
    f. Cables shall not lie directly on nor attach to ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

22. Re-enterable cable tie wraps shall be, “limited-combustible” and air plenum rated, reusable, color coded. Chemically and mechanically compatible with the respective cables and install locations. Shall allow multiple open-close operations for securing cables.
23. Electronic network cables containing non-dielectric components shall be installed with a minimum separation from other electrical power conductors and equipment as follows:

	Equipment Type	Minimum Separation
a.	Lighting fixtures	12 inches
b.	Electric motors, electric solenoids, electric Heaters	40 inches
c.	Transformers	48 inches
d.	Circuits over 100 volts to ground, in metallic raceways	5 inches
e.	Circuits over 100 volts to ground, in non-metallic raceway or without any raceway	12 inches
f.	Circuits over 100 volts to ground, suspended on overhead pole lines	48 inches

D. Movement, Storage, and Handling of Cable:

1. Reels of cable shall not be dropped from any height, from trucks or other transporting equipment.
2. Lift and move cable reels using following methods:

    a. Crane or boom type equipment-insert shaft (heavy rod or pipe) through reel hubs and lift with slings on shaft, with spreader or yoke to reduce or avoid sling

pressure against reel head.

b. Forklift type of equipment may be used to move smaller, narrower width reels. Fork tines should be placed so that lift pressure is on reel heads, not on cable, and shall reach all the way across reels so lift is against both reel heads.

c. Reels may be moved short distances by rolling. Reels shall be rolled in the direction indicated by arrows painted on reel heads. Surfaces over which the reels are to be rolled shall be solid clear of debris, and also clear of protruding stones, humps, etc. which might damage the cable if the reel straddles them.

3. Storage of reels of cable:

a. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2-inches down to insulation. Then apply four layers

b. of an insulating tape criss-cross over the cable end and carry back at least 4-inches onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

c. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Additional covering such as tarpaulin, plastic sheeting, etc. shall be used if cable is to be stored outdoors.

d. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

e. Use fencing or other barriers to protect cables and reels against damage by vehicles or other equipment moving about in the storage area.

3.5 CABLE SPLICES

A. General

1. Splice(s) in cables shall occur only in the following locations:

a. Pullboxes or manholes.
b. Terminal backboard, closets or rooms.
c. Equipment racks.
d. Wall mounted interface cabinet.
e. Do not splice cables in conduit, cable tray, raceways or plenums.

2. Polarity and color-coding shall be maintained consistent through splices, terminations and outlets for the entire electronic network system.

3. Cable splices in outdoor areas, manholes, pullholes shall be water tight, inside universal splice enclosures.

B. Fiber optic cable splices unless specifically indicated otherwise below, fiber optic cable splices between fiber optic cables fibers shall be fusion type splices.

1. Splices between loose tube gel filled fiber optic cable fibers shall be fusion type splices.
2. Splices between indoor/outdoor fiber optic cable fibers shall be fusion type.
3. "Pigtail" splices of tight buffered and indoor/outdoor fiber optic cable fibers to loose tube gel filled cables shall be fusion type splice.
4. Splices between tight buffered fiber optic cable fibers to indoor/outdoor fiber optic cables shall be fusion type splice or mechanical type splice.
5. Splices between tight buffered fiber optic cable fibers shall be mechanical type splice or

fusion type splice.

6. "Pigtail" splices of tight buffered fiber optic cable fibers to tight buffered fiber optic cable fibers shall be mechanical type splice or fusion type splice.
7. Fiber optic splices shall be performed to maintain the data transmission rates specified for the entire respective system.

C. Copper Wire Splice

1. Copper wire extending from infrastructure workstation outlets to respective equipment rack patch panel outlets shall not be cut or broken and shall be continuous end to end.
2. Copper wire extending from telephone/voice workstation outlets to respective terminal blocks shall not be cut or broken and shall be continuous end to end.
3. Continuity of cable shields (where occurs), polarity and color coding shall be maintained across all splices.

4. Copper wire splices shall be performed to maintain the data transmission rates specified for the entire respective system.

3.6 CABLE TERMINATIONS

A. General

1. Infrastructure workstation outlets connecting to ports in patch panels and terminal blocks shall be grouped together in the patch panel and terminal block by outlet function, room location and building area location (i.e. Group #l Room #120 1st floor; Group #2 Room #200 east wing, etc.). Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
3. Terminate all cables onto respective outlets connectors, interconnection couplers and terminals. Terminations shall comply with Manufacturer's recommendations; ANSI/TIA/EIA-568C related Standards, Amendments and TSB.
4. Fiber optic cable fiber strands and copper wire cable conductors terminated at outlet locations shall be connected with a strain relief device attached to the cable jacket to prevent cable tension from being transmitted to the termination connectors.
5. Cable terminations shall be performed to maintain the data transmission rates specified for respective entire system.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together (Duplex-Pair) for purposes of identification and connection transmit/receive pair. Each pair of connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber duplex-pair interconnection couplers at each patch panel. The horizontal/ vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

4. Fiber optic cable fiber strands terminated at patch panels shall be installed with a minimum of 540 degrees of each fiber strand looped around the splice tray individual fiber ”training” rings.
5. Fiber optic cable connecting from infrastructure workstation outlet to a fiber optic patch panel.

    a. The connectors for fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers.
    b. The patch panel coupler shall be color coded to identify the polarity of the transmitting and receiving optical fibers.

6. Fiber optic cable connections at workstation outlets.

    a. The connectors for fibers shall be "plugged" into separate physically adjacent fiber optic fiber interconnection couplers in the outlet.

C. Copper Wire Terminations

1. Where occurs, the shield on metal shielded copper wire shall be terminated and connected to the shield grounding connection at each termination point.
2. Twisted wire pairs shall not be untwisted for a length of more than 0.4-inch at any location and the cable jacket shall not be striped back not more than 0.5 inch any location including splices and terminations.
3. Unless specifically directed otherwise by the Owner's Representative, Pin assignment for wiring terminations shall comply with ANSI/TIA/EIA-568C type T568A or Type T568B as required for compatibility with the electronic network equipment. The termination type shall be consistent throughout the Project Contract area.
4. Copper wire termination's shall be performed to maintain the transmission rates specified for the respective entire system.

3.7 EQUIPMENT RACKS

A. General

1. Install, assemble, mount and connect devices and equipment in the respective equipment racks, bolted securely to the rack frame with stainless steel hardware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.
2. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, Manufacturer's standard finish color.
3. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire infrastructure workstation outlet and copper wire cable shown connected to the respective equipment rack, plus the spare copper wire outlet connectors required in the Contract Documents. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels. In no case shall the quantity of equipment rack mounted copper wire outlet connectors be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.
4. Provide fiber optic fiber connectors and fiber optic fiber interconnection couplers in the respective equipment rack for each remote fiber optic infrastructure workstation outlet, and fiber optics cable fiber shown connected to the respective equipment rack, plus the spare fiber optic fiber connectors required in the Contract Documents. The fiber optic fiber connectors and fiber optic fiber interconnection couplers in the equipment racks

shall be provided in equipment rack mounted fiber optic fiber distribution enclosures (RTDE). In no case shall the quantity of equipment rack mounted fiber optic fiber connectors and fiber optic fiber interconnection couplers be less than the quantity of cables indicated on the Drawings, plus required spaces/spares.

5. Fiber optics cable fibers specifically shown as non-terminated "splicing-thru" in the equipment rack shall route through fiber optic splice only enclosures (RMSE), mounted in the respective equipment rack.
6. The maximum quantity of cable terminations, in each equipment rack mounted patch panels shall not exceed the following. To insure not less than 50% of the rack space remains available for equipment installation:

    a. 100% copper wire outlet connectors, 196 maximum per rack.
    b. 100% fiber optic fiber terminations, 144 maximum per rack.
    c. Combination of copper wire outlet connectors and fiber optic fiber terminations in the same rack; 48 maximum fiber optic fibers plus 144 maximum copper wire outlet connectors per rack. 18 maximum fibers plus 48 maximum copper wire in 30 inches high.
    d. In addition to the quantity of patch panel outlets for termination of incoming and outgoing cables, provide not less than an additional 15% of patch panel spare outlets of each type, in each equipment rack for future use.

7. Provide additional equipment racks, quantity of racks to ensure the maximum specified quantity of terminations in single rack are not exceeded and the quantity of cable terminations complies with the Requirements of the Contract Documents.
8. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.
9. Equipment Rack Anchorage:

    a. Equipment racks installed on raised "access floor" systems, shall be supported and anchored with bolts that extend into the "structural" floor located below the "access floor".
    b. Securely anchor the support arms of swing gate racks to the wall structural support system.
    c. Securely anchor fixed support base of the racks to the floor.
    d. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.
    e. Attachments and anchorages shall comply with the Requirements for earthquake seismic rating at the install location.

10. Unless specifically noted, otherwise provide the following equipment rack types:

    a. Floor standing equipment racks containing patch panel locations, computer/data network HUBS/switches and computer data network concentrators, shall be Swing Gate style equipment racks.
    b. Floor standing equipment racks containing multimedia, audio/video, TV head end equipment, shall be Metal Enclosed equipment racks.
    c. Wall mounted external to dedicated IDF/MDF terminal rooms/closets (i.e. inside individual classrooms), shall be Mini-Equipment racks.

11. Install ground bus, PDU/SPD, cable management rings, equipment, patch panel and patch panel out-lets, etc. in equipment racks.
12. Equipment rack terminology:

a. The location containing the main campus equipment rack location shall be identified as the Main Distribution Frame – (MDF).
b. The locations remote from the MDF containing satellite equipment racks shall be identified as Intermediate Distribution Frames (IDF).
c. A individual building located on a multi-building campus site with multiple equipment rack locations in the building, the building main rack location shall be identified as Sub-MDF (or building MDF) and the remaining equipment rack locations in the building shall be identified as IDF.
d. Floor Standing Equipment Racks
e. General:
f. Securely anchor racks to floor.
g. All incoming cables shall enter through the top or bottom of the racks.
h. The front of the racks shall maintain a minimum of 42-inches of clear working space.
i. Multiple floor standing racks shall be installed directly adjacent to each other (i.e. side by side), with not less than 6-inches (edge-to-edge) space between adjacent racks.
j. Cables entering racks shall enter into the top of the rack from overhead cable tray, or from wall along wall support arms to rack.

13. Floor standing metal enclosed equipment racks:

a. The rear of the rack shall maintain a minimum of 36 inches clear working space.
b. Provide a minimum spacing between adjacent (edge-to-edge) racks of not less than 6-inches.

14. Floor standing open (non-swing gate) equipment racks.

a. The rear of the rack shall maintain a minimum of 54-inches clear working space behind the rack frame rails for adequate installation depth of HUBS/switches equipment, for "walk" behind access to equipment and for cable terminations access.
b. Provide a minimum spacing between (edge-to-edge) racks of not less than 6-inches.

15. Floor standing modular frame equipment racks:

a. The rear of the racks shall abut against the wall, or as shown on the Drawing.

3.8 TELEPHONE/VOICE TERMINAL BLOCKS

A. The telephone/voice terminal blocks shall be assembled in vertical sections, for wall mounting. Install adjacent vertical sections with not less than 8-inch blank space between sections, for cable training space.

B. Install terminal blocks on plywood terminal backboard with #8 x 1-inch wood screws. Minimum 6-inches on center, along each side of each terminal block.

C. Terminal block wire pair capacity:

1. The minimum wire termination capacity shall not be less than 600 pairs of telephone/voice conductors, at any telephone/voice terminal block.
2. The quantity of wire pair terminations provided at each terminal block shall be based on the following formula. However, under no case shall any terminal block wire pair capacity be less than the specified minimum.

   Total quantity of telephone/voice feeder copper wire pairs connected to the terminal board = QFP Total quantity of telephone/voice outlets connected to terminal board - QTO
   (QFP) x (QTO x 4) + (specified spares) = Minimum terminal block pair capacity.

3.9 MDF AND IDF CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Terminal Backboard

1. A ¾-inch thick marine "A-C" grade plywood backboard shall fully cover each wall of terminal closets and terminal rooms, including all MDF and IDF rooms/closets. Provide backboard on the wall for equipment racks, incoming cable raceways and terminal blocks. Plywood shall extend continuous from the finish floor to 8-feet above the finish floor on all walls. "A" side of plywood shall be exposed.
2. Attach plywood to wall structural framing with mechanical fasteners a minimum 6-inches on center vertically on walls at each framing vertical member, and along the length of the wall, but not less than 16 inches on center horizontally along the length of the wall.
3. Paint plywood terminal backboards after installation and prior to mounting any equipment. One coat of wood paint fire resistant primer and two coats of fire resistant/intumescent, non-conductive finish coats of paint. Finish color matt/ flat white, acrylic enamel fire resistant/retardant latex paint.

B. Cable Tray

1. Locations with equipment racks, and/or terminal blocks are installed in the same room/closet (MDF or IDF).

   a. Provide a horizontal cable tray above the equipment racks and terminal blocks in each circuit terminal room and closet.
   b. Provide a horizontal cable tray continuous “loop” around the perimeter inside each MDF and IDF room, within 12-inches of the ceiling. Parallel with and adjacent to all walls in the room.

2. Ladder type cable tray 18 inches wide by 6 inches deep; length-end wall to end wall, of the closet or room.
3. Install the cable tray centered above all equipment racks, and around the room perimeter at ceiling/ walls and terminal blocks with ceiling and wall suspension system. Install trays not more than 36-inches above and not less than 12-inches above the top of the equipment racks.
4. Where multiple segments of cable trays occur in terminal closets and rooms, provide interconnecting cable trays between each segment located in the respective room/closet.

C. Conductor Training and Support

1. Provide conductor/cable training and racking support distribution rings installed on

backboards. As manufactured by Newton 3042 series, Saunders or equal.

2. Support rings shall be spaced a minimum of 10-inches on center along all cable/conductor routing paths on backboards and within 4-inches of each change in cable/conductor direction.
3. The capacity of support rings shall be equal to the weight and quantity of conductors/cables passing through the respective support ring plus 100% spare capacity for installation future conductors/cables. In no case shall support rings be smaller than 3 inches.
4. Attach support rings to backboards with not less than two 3/8-inch diameter by 1⅛-inch long threaded wood anchor bolts for each individual bracket.

D. Environment Space Monitoring (MDF and IDF)

1. In each room/closet provide one automatic environmental monitor. Self-calibrating, simultaneous monitoring and software programmable, with alarm set points. Shall measure and monitor ambient conditions and provide data-logging for conditions in the space for the following:

   a. One ambient temperature port and plug-in indoor sensor.
   b. One ambient humidity port and plug-in indoor sensor.
   c. One spare plug-in port for an external digital sensor.

2. Digital Fast Ethernet LAN RJ-45 communications port, with alarm alerting and communications software for remote monitoring of the ambient conditions via the LAN. Multi-user site wide software license, compatible with PC-computer and IP-WEB HTTP remote operations.
3. Local internal audio and visual alert annunciators, with local silence and reset.
4. 120 volt, 60Hz AC input power supply operation. Equipment rack mount self-contained unit housing configuration. Provide all interconnect cabling and connectors.
5. Provide the environmental unit in one of the equipment racks located in each of the respective spaces.
6. As manufactured by Avtech-Room Alert; or SensaTronic-Evironmental Systems; or IT Watch Dog- Climate Monitors.

3.10 GROUND (ADDITIONAL REQUIREMENTS)

A. Electronic Equipment MDF, IDF and Terminal Rooms and Closets

1. Terminal Equipment Ground Bus (TEGB) - Provide a wall mounted TEGB ground bus in each MDF location. Also provide a TEGB where two or more equipment racks and/or terminal blocks are provided in each IDF. The TEGB ground bus shall be copper ¼-inch by 2-inches (nominal) by 12-inches long (minimum). Install the TEGB on the wall with a minimum of two "stand-off" electrical insulators. Drill and tap the ground bus and provide bolted type ground lugs for connection of each ground conductors size #10AWG - #1AWG. Provide four spare unused ground lugs on the TEGB.
2. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB homerun to the building main ground reference bus. Provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB homerun to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.

a. Provide the same ground connections from the equipment rack ground bus where only a single equipment rack occurs in the IDF location.

3. The ground conductor required from the TEGB to the building main ground reference bus may be looped and connected between separate TEGB ground bus locations if all of the following conditions are met.

a. The ground conductor is increased to 1.5-inch conduit with 1#2/0AWG copper insulated and the total end to end length does not exceed 300-feet.
b. The building exceeds two floors in height.
c. Not more than four TEGB buses are connected to the same "looped" ground conductor.
d. The TEGB ground conductor is continuous (not cut, spliced or broken) along its entire length.
e. The TEGB ground conductor is connected to the TEGB ground buses with a UL listed "Exothermic" welding process.

B. Equipment Racks:

1. Provide a separate 12AWG copper stranded green insulated ground conductor from each individual equipment element in the rack to the respective rack ground bus.
2. Provide a separate #8AWG copper insulated ground conductor from each equipment rack ground bus to the TEGB terminal equipment ground bus located in the same space.
3. Where only one equipment rack is installed, provide 1.25-inch conduit with 1#1AWG copper insulated ground homerun conductor from the equipment rack ground bus homerun to the building main ground reference bus and provide 1.25-inch conduit with 1#1AWG copper insulated ground conductor from the TEGB or single equipment rack ground bus (as applicable), to the nearest building main structural steel member and to the nearest metal cold water pipe larger than 0.6-inch diameter pipe.
4. Provide 1.25-inch conduit with 1#4AWG copper insulated ground conductor from each wall mounted fiber interface cabinet to the respective TEGB ground buses.
5. Provide a 1#10AWG copper insulated ground conductor connecting in a continuous loop to all miscellaneous cable trays and metal support equipment located in the terminal closet or room and connect to the TEGB ground bus.

C. Telephone/Voice Terminal Blocks:

1. Provide a separate #8 copper insulated ground conductor from each terminal block section ground bus to the TEGB terminal equipment ground bus.
2. Provide a separate #6 copper insulated ground conductor from the terminal room/closet to the lightning ground system.

3.11 WALL MOUNTED FIBER INTERFACE CABINET - WMIC

3.12 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. General

1. Fiber optic and copper wire cables shall be identified in each manhole, pull box, equipment rack, patch panel and computer workstation outlets.

2. Infrastructure documentation, identification labels and color coding shall comply with ANSI/TIA/EIA- 606A Administration Standard for Telecommunications Infrastructures, Class-1 thru Class-4. Provide management software MS-Windows-based single user license, with all as-built data entry documentation information complete.

B. Identification tags shall include the following information:

1. Cable name as indicated on Drawings (i.e., HV1, F4, MSB3 etc.).
2. Installation month and date (i.e., 3/92, 4/78 etc.).
3. Conductor size conductor type (i.e., loose tube fiber; #24AWG ScTP Category 5, 200-pair, tele-phone/ voice etc.).
4. Feeder taps to equipment or building shall also be identified with equipment name or building (i.e. library, SW1, Rack #21, etc.)

C. Identification Tags

1. Tags shall be ⅛-inch thick 98% lead, approximately 2-inch square with chamfered corners. Two holes shall be drilled for attachment to primary cable. Lettering shall be ⅛-inch high, engraved or die stamped. Attach tags to primary cables with two #14AWG (THWN insulated) solid copper conductors "twist- tied", with insulated CAP wire-nut on the tie-wire ends, to cover sharp edges of tie-wire conductor.
2. Alternate identification tags, at the Contractor's option in lieu of lead tags. Provide polypropylene tag holders with interchangeable, yellow polypropylene tag with black alphanumeric characters sets. Characters shall be approximately .25-inch high. As manufactured by Almetek industries "EZTAG" - Ledgewood, New Jersey.

D. Equipment and outlet naming identification and color-coding shall comply with ANSI/EIA/TIA latest revision.

1. Naming method for equipment, outlets and cables; where a position in the naming string is unused, provide multiple "****" symbols.

Typical naming string "ADM-02-1141-PP17-1271"

a. "ADM" - Abbreviated Building Name or Number (i.e., Administration, B127, etc.)
b. "02" - Floor Level #2 or as applicable.
c. "1141" - Outlet, Equipment or Terminal Room/Closet name or room number as applicable.
d. "PP17" - Terminal Rack Patch Panel Identification.
e. "1271" - Individual Outlet or Port Identification.

2. Connecting hardware color coding shall be as follows: "Green" - Main central terminal location for entire site.

"White" - Distributed terminal locations other than the main terminal.

"Blue" - Horizontal wiring hardware systems for workstations.

E. Provide warning nameplates on fiber optic patch panels, fiber optic outlets, and any location where fiber optic cables are terminated. Minimum ⅛-inch high engraved/etched letters.

"WARNING - LASER LIGHT SOURCE. DO NOT LOOK DIRECTLY AT OUTLET OR FIBER CABLE ENDS. RISK OF SEVERE EYE DAMAGE OR BLINDNESS".

END OF SECTION

SECTION 27 41 17 - SOUND, VIDEO, & COMMUNICATION SYSTEMS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED

A. The Sound, Video & Communication System Contractor (SVCC) shall be responsible for all labor, equipment, material, and procedures required for the supply, fabrication, installation, commissioning, and warranty of the Sound, Video & Communication System (SVC) as specified herein and on the SVC Contract Drawings, including design and engineering responsibilities, and submission for review of shop drawings, reports, samples, and mock-ups. Detailed descriptions of these requirements are included in “Part 1 - General” and “Part 3 - Execution”.

B. Requirements Included:

1. The scope of work of this Section shall include, but not necessarily be limited to, the following systems, equipment, material, arrangements, and procedures as indicated and specified herein for:

   a. All labor, equipment and materials.
   b. Supply nonstandard back boxes and floor-boxes for installation by Electrical Contractor except where noted.
   c. Termination of all SVC equipment racks.
   d. Provide supplemental conduit, junction/pull boxes, fittings, and electrical hardware, as required for connection of Sound equipment to the Sound empty conduit system as supplied by Electrical division.
   e. All wire, wire pulling, and termination.
   f. All tools and measuring & testing equipment required for installation.
   g. Daily and final cleanup.
   h. Shop drawings, samples and mock ups, as built documentation, and operating manual.
   i. Testing and adjustment, interim shop inspection, initial test report, final site inspection, final test report, and demonstration and instruction.
   j. Guarantee and warranties, and maintenance and service contract.

C. Sound, Video & Communication System:

1. See detailed description of the following system and specific information about the equipment, components, and material in “Part 2 Products”:

   a. Sound, Video & Communication System: Permanent Sound, Video & Communication System, including speech and music reinforcement, archival audio & video recording, music, effects, and prerecorded tracks processing and playback and stage monitor/foldback, utilizing the following subsystems:
   b. Permanent loudspeaker positions, including rigging points, and cable management.
   c. SVC equipment racks, including appropriate cabinetry.

D. Related Requirements:

1. The following systems, equipment, material, arrangements, and procedures are not included in the scope of work of this Section. Coordinate all work of this Section with the work specified in other sections (exceptions as noted):

   a. A complete, pull-ready conduit system for installation of Sound, Video & Communication System wiring and devices—including all conduit and raceway, junction/pull boxes, standard back boxes, terminal cabinets and "pull group" boxes, fittings, drag line (pull line), electrical hardware, etc. (Electrical Contractor).
   b. Electrical power service—including transformers, feeder cable, distribution panels, branch circuit panelboards, and individual wall receptacles (Electrical Contractor).
   c. Sound, Video & Communication System "Sound, Video & Communication System" isolated ground AC power network (Electrical Contractor). Note: inter-rack AC power wiring, shall be the responsibility of the SC. Single-point termination to the racks shall be conducted on-site by the EC.
   d. Loudspeaker suspension points
   e. Equipment rack room (including lighting, furnishings, and finishes) (various Trades).
   f. Painting and finishing (except as noted below for Sound, Video & Communication System equipment).
   g. House telephone, data, life safety, fire alarm, and security systems (Electrical Contractor).

E. Definitions

1. In addition to the definitions in the General Conditions, the following also apply to this Section:

   a. The term "Consultant" refers to Stages Consultants.
   b. The terms "Sound, Video & Communication System Contractor", "this Contractor", "SVCC" as used in this specification refer to that contractor directly responsible for supply and installation of the Sound, Video & Communication System.
   c. The terms "engineer" and "engineering" as used in this specification refers to the interpretation, organization, and execution of the design of the Sound, Video & Communication System as provided in the Contract Documents.
   d. The term "supply" as used in this specification indicates that the Sound, Video & Communication System Contractor shall supply, free issue, including instruction and supervision for installation by others, such equipment, components, and material of the Sound, Video & Communication System so as to fulfill the intent of the Contract Documents.
   e. The term "provide" as used in this specification indicates that the Sound, Video & Communication System Contractor shall supply, fabricate, install, and make operable such equipment, components, and material of the Sound, Video & Communication System so as to fulfill the intent of the Contract Documents.
   f. The terms "preapproved equivalent" and "or as approved" as used in this specification indicate that acceptance shall be obtained from the Consultant. Refer to "Product Substitution" below.

g. The terms “NIC” or “not in contract” as used in this specification indicate an item or system that shall be furnished under another contract. Preparation for the future inclusion of such an item or system shall be limited to the extent outlined in the Contract Documents.
h. The terms “OEM” or “original equipment manufacturer” or “manufacturer” as used in this specification refer to a direct supplier to the Sound, Video & Communication System Contractor.
i. “UON” denotes “unless otherwise noted.”
j. “AFF” denotes “above finished floor.”
k. “U” denotes “rack unit,” as in “10U” to denote 10 standard 44mm (1.75”) rack units, for a total of 440mm (17.5”) of rack space.

1.3 SOUND, VIDEO & COMMUNICATION SYSTEM CONTRACTOR

A. Pre-qualified Contractors:

1. ATK Audiotek
28238 Avenue Crocker
Valencia, CA 91355
661.705.3700
2. Pro Sound
11060 Randall St
Sun Valley, CA 91352
818.765.3800
3. Morgan Sound
2004 196th St SW
Lynnwood, WA 98036
866.860.8233
4. Sound Com Systems
9918 Windisch Road
West Chester, OH 45069
513.860.4160
5. AVI-SPL
540 Huntmar Park Dr, Suite B
Herndon, VA 20170
703.796.9011
6. Sound Associates, Inc
979 Saw Mill River Road
Yonkers, NY 10710
914.963.3453

B. Sound, Video & Communication System Contractor Qualification:

1. Contractors wishing to qualify for this project shall submit the following information:

a. Indicate the names of primary stock holders (in excess of 33-1/3%) and individuals, partnerships, or corporations with which the firm is currently affiliated in joint ventures.
b. List the principal officers, design and service engineers, and project managers. Provide an organizational structure flow chart.
c. Provide descriptions of Three (3) projects of comparable size, scope and nature for which the candidate has provided full services within the last five (5) years. These services should

include: project management, system engineering, shop drawings, custom fabrication, installation, commissioning, training, and maintenance. For each project indicate the specifics of the scope of engineering, fabrication, and installation. Include name, address, and phone number of the owner, architect, Sound, Video & Communication System consultant, and the person(s) directly responsible for the operation and maintenance of the equipment in each facility.

d. List all current projects and their approximate contract value. Include name, address, and phone number of the owner, owner's representative, Sound, Video & Communication System consultant, and architect. For each project name the individual(s) who supervised the project management, system engineering, preparation of shop drawings, fabrication of components, installation of equipment, acceptance testing, and commissioning and training.

C. Contractor Submittal

1. All contractors shall submit two (2) copies of the following lists, schedules, and bills of material, including the names of manufacturers, manufacturers' model numbers, quantities, and prices:

a. Complete pricing information including base price, add-alternates, and unit prices.
b. A complete and accurate list of all of the equipment, components, and material specified in the Contract Documents.
c. A schedule of wire and cable as specified in the Contract Documents.
d. A list of requests for approval of equivalent equipment, components, material, or systems, per the requirements listed in "Product Substitution" below.
e. A list of test equipment to be used in system testing and adjustment, per the requirements listed in "Part 3 Execution: Testing and Adjustment."
f. A list and description of any equipment or material required for completion of this Section that is not included in the Contract Documents and is not shown on the Architectural or Electrical Contract Documents as being specified by other sections.
g. A list and description of any changes required to the installation of the empty conduit system, including but not limited to relocation or resizing or reduced or additional conduit, for Sound, Video & Communication System equipment provided by the Electrical Contractor.
h. A separate cost amount, per year, for a maintenance and service contract for a period of five (5) years. Include a complete description of services to be furnished and a schedule of planned maintenance visits. When the Sound, Video & Communication System Contract is awarded, the Contractor shall be obligated to furnish the services described, for the fees quoted, should the Owner elect to purchase this separate contract prior to the end of the Guarantee and Warranty period. Refer to "Maintenance and Service Contract" below.
i. In the event that additional conduit is required to fulfill the intent of the Sound, Video & Communication System, the contractor shall include any additional wire.

j. Any financial or scheduling implications for additional work specified in other sections, as recommended by a contractor, shall be assessed prior to award of this Section.

D. Consultant Review

1. The Consultant shall refer to the lists, schedules, and bills of material outlined above in order to determine fulfillment of the requirements of the Contract Documents. These lists, schedules, and bills of material are included for the purpose of evaluation. The acceptance these submissions shall not be understood to relieve the Contractor of the responsibility of meeting any and all requirements of the Contract Documents.

E. Product Substitution

1. If an original equipment manufacturer or other supplier has permanently stopped fabrication of a specified item or has replaced an item with an almost identical item that has a new model number, the Contractor shall state this or, if there is sufficient time for amendment of the Contract Documents, notify the Consultant.
2. Contractors are advised that requests for approval of equivalent equipment, components, and material of other OEMs or suppliers are permitted. Such products shall be evaluated on the basis of equivalent quality and performance. The Consultant shall be the sole judge of performance equivalency and shall give written approval, by addendum, of all product substitutions. Provide sufficient catalog data, specifications, technical information, and samples to permit a complete evaluation by the Consultant.
3. While the equipment, material, arrangements, and procedures described in the Contract Documents indicate specific details for realization of the Sound, Video & Communication System, contractors may propose alternate products and details that shall fulfill the functional parameters of the outlined system. In such event, contractors shall submit a complete set of alternate Contract Documents not less detailed than these and following the same general format. Also submit a detailed statement indicating, paragraph by paragraph, where the equipment, material, arrangements, and procedures that shall be offered differ from those specified in the original Contract Documents.
4. Any changes to the original Contract Documents shall be evaluated and given written approval by the Consultant.

F. Responsibilities

1. Provide complete and working Sound, Video & Communication System as outlined in the Contract Documents.
2. Carry out work in accordance with best trade practices, and engineer, fabricate, provide and install all items in accordance with the Contract Documents, the manufacturers' recommendations and in compliance with applicable codes, and consult with other trades performing adjoining work in order to provide an installation of first class quality.

G. Extent

1. Provide all labor, equipment, material, and procedures required, listed, scheduled, mentioned, or implied in the Contract Documents to engineer, fabricate, install, and commission the Sound, Video & Communication System.

2. Provide also all labor, equipment, material, and any necessary incidental items not specifically called for in the Contract Documents but required for a complete and satisfactory installation of the Sound, Video & Communication System.
3. Ensure that all equipment, components, and material specified or otherwise required to complete the installation are compatible with each other and with the conditions of expected use. Any errors, omissions or ambiguities in the Contract Documents are not to condition these requirements but shall be brought to the attention of the General Contractor and Consultant for evaluation of any possible effect on the intent of the Contract Documents. Submit all notifications in writing to the General Contractor and Consultant. Lack of such notification shall be understood to indicate acceptance of all requirements of the Contract Documents, and any future claims shall be rejected.

H. Coordination

1. Refer to the Project Electrical Drawings, to determine Sound, Video & Communication System device quantities and general locations. Refer to Project Architectural drawings for exact device locations.
2. Be familiar with the requirements of the Electrical Contract to ensure the coordination of the work in this Section with the work of the Electrical Contractor.
3. Provide the Electrical Contractor with drawings, diagrams, and other information in order to ensure proper coordination of the AC power system and Sound, Video & Communication System empty conduit installations. This work shall be part of this Contractor's early coordination effort and shall be provided in a timely manner according to a schedule of the project established by the General Contractor.
4. Coordinate work of this Section with the work of other trades so that all installations are executed in such a manner as to ensure proper system performance. Provide appropriate mounting of equipment and components and avoid conflicts in positioning of the various installations of other contractors and trades.
5. References to the General Contractor or other trades shall in no way modify the responsibility of this Contractor to provide a coordinated, complete, and working installation of all work required by the Contract Documents.
6. All drawings, schedules, RFIs, and other communication shall be coordinated with and submitted through the General Contractor.

I. Means and Methods

1. The Sound, Video & Communication System Contractor is solely responsible for the means and methods of all manufacturing and installation techniques, sequences and procedures of construction, and shall be responsible for coordination of these items with and through the General Contractor and the Consultant.

J. Sub-Contractors

1. Use of Sub-Contractors by the Sound, Video & Communication System Contractor shall in no way modify its responsibility.

K. Suppliers

1. Use of a product from a particular original equipment manufacturer, whether specified in the Contract Documents or substituted by the

Sound, Video & Communication System Contractor, shall in no way modify its responsibility. Refer also to General Conditions.

L. Site Dimensions and Conditions

1. The Sound, Video & Communication System Contractor is solely responsible for the correctness of dimensions and quantities, shall verify site conditions, and obtain site dimensions and quantities required for proper installation of the work included in this Section; and shall be responsible for coordination of these with and through the General Contractor. The Sound, Video & Communication System Contractor shall take dimensions on site for all equipment and material that shall be provided (including custom fabricated components) and be entirely responsible for their accuracy.
2. Examine the work of other trades at the site to ensure that all aspects of the related work are in the proper condition to receive the work included in this Section.
3. Obtain through the General Contractor, where necessary, copies of relevant base building Contract Documents, including shop drawings, to ascertain existing field conditions not open to view (e.g., wall or ceiling construction).
4. In particular, verify all necessary field conditions including, but not limited to: the size, routing, and location of all conduit and raceway, pull/junction boxes, cast in-place back boxes, and accommodation of non-standard backboxes. Also verify size and configuration of the Equipment Rack Room. Such information is critical to the production of accurate shop drawings.
5. Provide any additional drawings, information, or templates where work by other trades must be modified for the proper installation and operation of the work included in this Section.
6. Do not begin manufacture of any custom fabricated equipment or components until satisfied that the devices, as designed, shall fit in the space available.
7. Provide all additional items required for the completion of the Sound empty conduit system, as supplied by the Electrical Contractor, including but not necessarily limited to conduit hardware, back boxes, and wire to accommodate site conditions, and in order to complete the interpretation of the Contract Documents with no change in the contract price. Any changes to equipment details and/or mounting details shall be reviewed and approved by the General Contractor and Consultant prior to shop fabrication or field installation.

M. Design and Engineering

1. The requirements outlined in the Contract Documents establish basic design parameters including means of operation, control, dimensions, and visual appearance. The Sound, Video & Communication System Contractor's design responsibilities shall include:
2. Interpreting the Contract Documents so as to accomplish the purposes described.
3. Carrying out the execution of the work.
4. Executing modifications and additions to the details as may be required to fulfill the intent of the Contract Documents.
5. Maintaining the design/control/operation concepts as described in the Contract Documents.
6. The Contract Documents describe performance attributes of the systems that shall be provided under this Section and, as such, are not

Professionally Engineered documents. This Contractor is responsible for the engineering of systems described in the Contract Documents.

N. Painting and Touch Up

1. The Sound, Video & Communication System Contractor shall be responsible for painting all Sound, Video & Communication System equipment and components exposed to view and shall also be responsible for the correction of minor cosmetic damage so that all Sound, Video & Communication System equipment and components are in clean and unblemished condition at the time of the final site inspection by the Owner and Consultant.
2. Any non-cosmetic damage shall be promptly repaired or replaced by this Contractor, prior to the final site inspection and without cost to the Owner.

O. Cleanup

1. Leave work areas clean and in proper order at the end of each work day. Coordinate with Owner's performance and rehearsal schedule, as required. Daily and final cleanup shall be to the satisfaction of the General Contractor and/or the Owner.

P. Omissions And/Or Errors

1. Omissions and/or errors within the Contract Documents shall not relieve this Contractor of the responsibility for providing a properly functioning installation of the Sound, Video & Communication System as outlined in "Part 2 - Products: System Description."

Q. Permits

1. Obtain all permits and pay all fees necessary for the execution of the work included in this Section.

R. Safety and Code Requirements

1. The Sound, Video & Communication System equipment, material, arrangements, and procedures shall conform to the applicable local building, electrical and safety codes and all other applicable code requirements, with industry standards of operation and practice, and applicable safety requirements. The completed installation shall allow the users to work and operate the Sound, Video & Communication System in a safe environment.
2. Regulations, codes of practice, and other reference documents cited in the Contract Documents shall apply to the work of this Section with the same authority as if included word for word in this specification.
3. Where provisions of the Contract Documents supplement those of cited reference documents, the more stringent provisions shall apply. Refer also to General Conditions.

1.4 SUBMITTALS

A. Project Timetable:

1. Submit a Sound, Video & Communication System project timetable for approval, after consultation with the General Contractor and the Consultant.

2. This timetable shall outline scheduling and dates for all project milestones including design and engineering, shop drawing submittal and review, sample and mock-up submittal and approval, shop fabrication, interim shop inspection, site installation, testing and adjustment, initial test report submittal and approval, final site inspection, programming, final test report submittal and approval, operating manual and as-built documentation submittal and approval, demonstration and instruction, and project completion.

B. Pre-Submittal Meeting:

1. The Sound, Video & Communication System Contractor shall meet with the General Contractor and the Consultant after the project timetable has been submitted and prior to beginning work on shop drawings. The project manager and chief project designer for the Sound, Video & Communication System Contractor must attend and be prepared to review the timetable, and to discuss the concepts described in the Contract Documents and proposed methods of execution of those concepts.

C. Shop Drawings:

1. Submit, through the General Contractor, shop drawings for submittal to the Consultant. Shop drawings shall include all information necessary to fully explain design features, engineering details, appearance, function, fabrication, mounting, installation, and interconnection of all equipment. This submittal shall include the following:

   a. Block diagrams (indicating all equipment interconnection and wiring).
   b. Schematic diagrams of custom circuitry and equipment.
   c. Equipment rack layouts.
   d. Custom receptacle plate, combination panel, and communication control pendant layouts (full scale drawings required).
   e. Custom mounting brackets.
   f. Mounting conditions and methods for all devices.
   g. Wiring distribution diagrams and wire pulling schedules.
   h. Detail drawings as required.

2. Submit names of the original equipment manufacturers or other suppliers, the specific model numbers of all Sound, Video & Communication System components, appropriate OEM catalog sheets, and technical data sheets. Submit also detailed descriptions of any required modifications to the specified equipment.
3. Submit a complete, itemized list of all equipment and material that shall be provided as part of the Sound, Video & Communication System. All equipment and material shall be listed by the same name, and in the same order as it appears in “Part 2 - Products.” Submit also similar lists for the portable equipment, spare parts, and test equipment to be supplied.
4. Shop drawings shall represent actual fabrication and installation details. Information on all shop drawings shall be designed, engineered, and drafted by this Contractor. Direct reproductions of contract drawings are not acceptable as shop drawings and shall be rejected.
5. Provide shop drawings separated into the various systems, where each set of drawings contains that information necessary to describe each system completely. The shop drawing submittal shall also include a fully referenced table of contents.

6. Consultant Review:

   a. The shop drawings shall be reviewed by the Consultant and shall be approved before the Sound, Video & Communication System Contractor begins fabrication and installation of any aspect of the Sound, Video & Communication System. Note that the review of shop drawings by the Consultant is to determine conformance with the design concept and with information included in the Contract Documents. Only those shop drawings returned to this Contractor with a satisfactory review status shall be used in the execution of this Section. Non-conformities and errors detected during the shop drawing review shall be noted on the drawings and returned to the Sound, Video & Communication System Contractor upon completion of the review. The Contractor is responsible for the completeness and accuracy of the shop drawings.
   b. Shop drawings or packages of shop drawings that are incomplete shall be marked “rejected” until such time as the complete set of relevant drawings is submitted. It is impossible for the Consultant to adequately review technical equipment submissions unless all details have been adequately represented.
   c. Approval of those shop drawings that include any non-conformities or errors that are not detected during the Consultant’s review shall not relieve this Contractor of the sole responsibility to provide an installation adhering strictly to the requirements of the Contract Documents.
   d. Shop drawing review does not include engineering calculations by the Consultant unless expressly indicated on the drawings.

D. Samples And Mock-Ups:

1. After review of appropriate shop drawings, submit one (1) sample each of the following items, clearly labeled with manufacturer name, model number, and other pertinent data, for approval by the Consultant:
2. All cloth and/or metal grille material, with integral framing or support construction where appropriate.
3. Custom paint samples for Sound, Video & Communication System devices requiring a change in color from that supplied by the manufacturer. Each sample shall be applied to a 150mm x 150mm (6” x 6”) piece of material closely matching the surface characteristics of each device type to be painted. On the back of each sample indicate the painting system, type of paint for each coat (including primer), the color and sheen of the finish coat, and description of the item(s) and location(s) where the color on the paint sample will be used.

E. Record Drawings:

1. Keep a complete set of white prints of the specification and all contract drawings for this Section of the work, as well as shop and installation drawings. Any changes made during installation should be carefully noted and transferred to the appropriate documents to show “as-installed” work in accordance with Section 1, Submittals.
2. At the time of the initial test report submission, submit one (1) corrected set of record drawings and shop/installation drawings for review by the Consultant.

3. Late changes or adjustments performed as corrections to punch list items or as change orders after practical completion of the contract, shall be reflected on updated record drawings by this Contractor.
4. After review by the Consultant, make any required revisions to the record drawings until the contents are satisfactory to the Consultant.

F. Operating Manual:

1. Provide one (1) copy of operating manuals in accordance with Section 1, Submittals. Mark each section with tabular dividers using permanent labels protected by plastic. All drawings (B-size and larger) shall be folded into individual vinyl pockets (sheet protectors). Include the following items:

   a. Title sheet labeled “Sound, Video & Communication System—Operating Manual”, project name, and date.
   b. Table of contents.
   c. Names, addresses, and phone numbers of Sound, Video & Communication System Contractor, sub-Contractors, and suppliers.
   d. Final version of the equipment list.
   e. System description.
   f. Operating instructions.
   g. Periodic maintenance procedures.
   h. List of all spare parts and equipment.
   i. Complete OEM data sheets, operating manuals, service manuals, and related documentation.
   j. Block and schematic diagrams of all systems.
   k. Plugging key plan, showing wiring and receptacles (i.e., a quick-reference chart of combination panels, wall receptacles, and patching only).
   l. Device, wiring, termination, and hardware schedules.
   m. List of equipment design parameters including safe working capacities, maximum simultaneous operations, and similar information.
   n. Maintenance instructions for finished surfaces and material.
   o. Record of performance (Final Test Report data) as demonstrated at final site inspection sessions.

2. Prepare one (1) draft copy of the Operating Manual for review by the Consultant four (4) weeks prior to the final site inspection. The document shall be clearly marked “FOR REVIEW.” After review by the Consultant, make any required revisions to the Operating Manual until the contents are satisfactory to the Consultant.

G. Mounted Block Diagram:

1. Provide prints of each Sound, Video & Communication System block diagram in the equipment rack room. Mount each diagram in a poster frame and securely mount in each control/rack room adjacent to the equipment racks. Block diagrams shall be of approved record drawings.

1.5 COMMISSIONING

A. Testing and Adjustment:

1. Perform tests and adjustments to the Sound, Video & Communication System at the project milestones indicated below, and as specifically outlined in “Part 3 - Execution: Testing and Adjustment.”

B. Interim Shop Inspection:

1. Test and demonstrate the functions of all systems, equipment, assemblies, and subassemblies of the Sound, Video & Communication System in the shop or factory no later than Six (6) weeks prior to project completion. Provide all test equipment, and perform all tests and demonstrations in the presence of the Consultant. The systems, equipment, and components that shall be tested and demonstrated include, but are not necessarily limited to, the following:

   a. Sound, Video & Communication System equipment, including playback computers, signal processing racks, amplification and loudspeakers.
   b. Notify the Consultant at least three (3) weeks prior to the date when all systems, equipment, assemblies, and subassemblies are complete and ready for testing. The equipment shall be made available to the Consultant for a period of at least one (1) week for testing and inspection prior to shipment. Do not ship any piece of equipment without either written verification of successful shop testing, or waiver of shop testing from the Consultant.
   c. Prepare a draft of the initial test report (outlined below), indicating all pre-installation or shop testing, and submit the report to the Consultant for review prior to shipment of equipment from this Contractor's shop.

C. Initial Test Report:

1. Perform all testing outlined in this specification. This shall occur after substantial performance of the Sound, Video & Communication System, and before scheduling the final site inspection.
2. Submit a complete report on the results of all testing and adjustments for review by the Consultant, and also certify, in writing, that the work of this Section is complete, operational in every respect, and that the Sound, Video & Communication System are ready for the final site inspection.

D. Final Site Inspection:

1. Upon approval of the initial test report, the Sound, Video & Communication System Contractor shall notify the General Contractor and Consultant, in writing, and schedule the final site inspection for a time no later than four (4) weeks prior to the scheduled substantial completion of the project. During this inspection demonstrate all the tests described in this specification, and be prepared to demonstrate the operation of any or all portions of the Sound, Video & Communication System, as requested by the Consultant.
2. Furnish sufficient technicians to operate all equipment and to perform such tests and adjustments as may be required by the Consultant during this inspection. Provide also sufficient engineering and field service personnel to aid the Owner and Consultant, and to direct the technicians in testing, adjusting, and explaining the systems. Ensure that ladders and other means are provided to allow access to all devices to be tested. Ensure that no other work is scheduled in the audience chamber or stage areas during the time of this inspection. All temporary bracing, scaffolding, etc., shall be removed to permit full operation of, and access to, all equipment.
3. Should the work inspected not be substantially performed at the time of first inspection, this Contractor shall compensate the Owner for any

consulting and transportation costs incurred by the Owner and Consultant during all inspections.

4. If the system does not fulfill each and every aspect of the Contract Documents, make all necessary adjustments or other required changes in order to bring the installation into conformance with the Contract Documents at no additional cost to the Owner.

E. Installed System Measurement, Verification and Optimization:

1. Upon completion of the Final Test procedure, proceed with the comprehensive complex measurement of the electroacoustic performance of the various components of the performance-related sound equipment. This testing procedure includes all of the signal path leading up to and through the loudspeaker systems and their processors. This contractor shall provide a SMAART measurement system and will have subcontracted a Consultant-approved SMAART operator who will conduct the actual measurements and supervise the optimization of these systems. This measurement process shall be scheduled for a period of two (2) consecutive days. Ensure that no other work is scheduled in the ride area during the time of this procedure. All temporary bracing, scaffolding, etc., shall be removed to permit full operation of, and access to, all equipment.
2. Furnish sufficient technicians to help operate all Sound, Video & Communication System equipment and to perform the various corrective tasks that are revealed during this procedure, including rigging adjustments and polarity correction. Provide all required support equipment such as computer monitors, keyboards, two-way radios, etc. Ensure that ladders and other means are provided to allow access to all devices to be tested.

F. Programming:

1. Following completion of System Optimization, the Consultant and Project creative team will undertake a two-week Ride programming period. Contractor shall provide full technical personnel support during this process.

G. Final Test Report:

1. After completion of the final site inspection and system optimization, submit a final version of the complete report on all testing and adjustment outlined in this specification for review by the Consultant. The final test report shall be accompanied by a letter certifying that the Sound, Video & Communication System conform to the Contract Documents, that the installation is complete in all details, that the final site inspection is complete and successful, that the system optimization is complete in all details and that the system ready to be turned over to the Owner. Include printouts of SIM II measurement plots showing pre and post optimization.

H. Demonstration And Instruction:

1. Instruct the Owner and/or the facility’s operating personnel in the operation and care of the systems during two (2) separate sessions for not less than a total of eight (8) hours. This instruction shall include:
2. Operating procedures for proper use of all systems.
3. Proper maintenance of all systems.
4. Replacement procedures for user replaceable parts.

5. The first demonstration and instruction session shall occur directly after acceptance of the final test report. The second session shall occur at a time arranged by the Owner and/or the facility's operating personnel, and shall be no sooner than the next day and no later than one (1) month afterwards. The precise timing of these sessions shall be determined by the Owner, at the Owner's convenience. The sessions shall be videotaped by this Contractor on portable video equipment. A dvd of the recorded session shall be submitted to the Owner within one (1) week following the taping.
6. As a portion of this instruction, present the final, approved, version of the Operating Manual to the Owner, General Contractor and Consultant for preview at least two (2) weeks prior to the first instruction session. Review the contents of the Operating Manual with the Owner and/or the facility's operating personnel as part of the first session.

I. Guarantee And Warranties:

1. Furnish the Owner with a written guarantee in accordance with General Conditions, covering all engineering, equipment, material, and installation workmanship incorporated into the work of this Section, until one (1) year after date of substantial completion of the project.
2. Service Calls
   a. All guarantee and warranty work shall be carried out at no additional cost to the Owner for any labor, parts, shipping or transportation. Warranty replacement equipment shall be provided within 24 hours of official notice by the Owner.
3. Equipment Warranties
   a. Warranty of replacement equipment and components shall be the same as for the original devices, and shall begin on the date of installation of the replacement item. Replace spare parts used during the warranty period at no additional cost. Note all such replacement equipment and components in a written report to the Owner and the Consultant, and in an addendum to the Operating Manual.
   b. In the absence of a maintenance and service contract (outlined below), honor all extended warranties offered by original equipment manufacturers beyond the one (1) year guarantee outlined above. The Sound, Video & Communication System Contractor shall not be responsible for any labor, transportation, shipping, or miscellaneous costs not covered by the OEM incurred during service calls to repair or replace extended warranty equipment.
4. Follow-Up Testing and Adjustment
   a. Provide technicians to test and adjust the Sound, Video & Communication System, at a mutually agreed upon time, approximately six (6) months after substantial completion of the project. This follow-up visit shall include any needed testing and repair of all items covered under the guarantee, and testing and readjustment of all items identified in the maintenance procedures. Provide a written report to the Owner and Consultant outlining the extent and results of the follow-up testing and adjustment.
5. Repeated Failures

a. If a particular component, part, or piece of equipment fails more than three times during the warranty period, the failure shall be deemed to be due to engineering and/or installation error. In this event take action within 24 hours of official notice by the Owner to modify or correct the defect by replacement of faulty equipment and/or changes to engineering concepts or installation methods.

J. Maintenance and Service Contract:

1. In addition to providing guarantee and warranty service, make available to the Owner a separate service contract to begin after expiration of the guarantee and warranties outlined above. The service contract shall be at the Owner's cost, renewable yearly, and available for the life of the Sound, Video & Communication System. This service contract may be provided directly by this Contractor or through an approved local or regional service center.
2. The service contract shall cover every item provided and supplied under this section of the contract. Service offered shall include, but not necessarily be limited to, repair of components, temporary equipment, replacement of parts, and a regular maintenance program for all equipment in the Sound, Video & Communication System. The service contract shall specify a guaranteed response time.

PART 2 – PRODUCTS

2.1 ASSEMBLY (DRAMA ART) ROOM 116:

A. Assembly (Drama Art) Room 116 will be a multi-purpose assembly, presentation and performance space. It will be equipped with a flexible system of wires and cables to allow for portable equipment to be utilized on an ad-hoc basis with supporting infrastructure and equipment to be permanently located within an equipment rack (SVC RACK 2) within an adjacent Electricity Closet (Room 121.) Additional supporting infrastructure and equipment will be permanently installed in adjacent rooms Utility (Room 120) and Dressing (Room 115.) The Assembly Room shall be supplied with an American with Disabilities Act compliant Assisted Listening System, which shall be fed by a permanently mounted stereo microphone, located in the ceiling. This same microphone shall also provide program feeds of the Assembly Room presentations to adjacent loudspeakers in the Open Air Lobby as well as the Dressing Room 115. All equipment shall be contractor nominated and subject to the owner's and consultant's review and approval.

1. Main Loudspeaker System – The main loudspeaker system shall be comprised of no fewer than Two (2) Full Range Loudspeakers (40Hz – 20kHz) and Two (2) Subwoofer Loudspeakers (20Hz – 120Hz) capable of providing even coverage throughout the Assembly Room and capable of providing continuous program levels of 100dB C-weighted with peak program ability not to exceed 120 dB C-weighted instantaneously. All loudspeakers should be equipped with de-mountable rigging hardware and safety equipment that will allow for them to be rigged overhead or ground-stacked. The Main Loudspeaker System shall be connected using portable cables to infrastructure-based panels located throughout the room and, through a loudspeaker patch bay, to permanently installed power amplifiers which will derive their signal from a Digital Signal Processor (DSP.) The DSP shall be freely patchable through patch bays

to allow for multiple ad-hoc configurations and controlled through computer network interface.

a. Two (2) Full Range Loudspeakers and Rigging

1) Basis of design: Fulcrum Acoustic DX-115

b. Two (2) Subwoofer Loudspeakers and Rigging

1) Basis of design: Fulcrum Acoustic Sub215L

c. Four (4) Loudspeaker Cables, 4 Channel, NL4, 25 Feet
d. Two (2) Loudspeaker Cables, 4 Channel, NL4, 50 Feet
e. One (1) Custom Loudspeaker Patch Panel

1) To be installed in SVC Rack 2

f. Two (2) 4-Channel Loudspeaker Amplifiers

1) 2000 Watts per channel @ 4 Ohms
2) Dante Network Audio Capable
3) To be housed in SVC Rack 2

g. One (1) Digital Signal Processor

1) Basis of design: Allen + Heath AHM64
2) Dante Network Audio Capable
3) 12 x 12 Analog Audio Input and Output
4) Network Controllable
5) Multiple recallable configurations
6) To be housed in SVC Rack 2

h. One (1) Analog Patch Bay

1) Capable of patching analog signals from all suitable infrastructure including Mic / Tie Lines from Assembly Room, SVC Rack 1, and the DSP.

2. Effect and Monitor Loudspeakers – The effect and monitor loudspeakers shall be comprised of no fewer than Four (4) Full Range Loudspeakers that shall be employed throughout the Assembly Room as-needed and capable of providing continuous program levels of 100dB C-weighted with peak program ability not to exceed 120 dB C-weighted instantaneously. All loudspeakers should be equipped with de-mountable rigging hardware and safety equipment that will allow for them to be rigged overhead or ground-stacked. The effect and monitor loudspeakers shall be connected using portable cables to infrastructure-based panels located throughout the room and, through a loudspeaker patch bay, to permanently installed power amplifiers which will derive their signal from the Digital Signal Processor (DSP) as stated above.

a. Four (4) Full Range Loudspeakers and Rigging

1) Basis of design: Fulcrum Acoustic FA-12

b. Four (4) Loudspeaker Support Stands

1) Basis of design: Ultimate Support TS90-B

c. Four (4) Loudspeaker Cables, 4 Channel, NL4, 25 Feet
d. Two (2) Loudspeaker Cables, 4 Channel, NL4, 50 Feet
e. Two (1) 4-Channel Loudspeaker Amplifiers

1) 800 Watts per channel @ 4 Ohms

2) Dante Network Audio Capable
3) To be housed in SVC Rack 2

3. Audio Console – The audio console shall provide a functional and expandable interface of the Assembly Room operators to allow for control of the Main Loudspeaker System and the Effects and Monitor Loudspeakers. It shall be connected using portable cables to infrastructure-based panels located throughout the room and, through a Category6 cabling patchbay, to the DSP as stated above and additional auxiliary stagebox.

a. One (1) Digital Mixing Audio Console

1) Basis of design: Behringer X-32
2) Provide with Dante Network Audio capability

b. One (1) Portable Digital Stagebox

1) Basis of design: Behringer S-32
2) Provide with hard-sided portable roadcase and power management.

c. Six (6) Category6e Shielded Twisted Pair Cables, 25 Feet
d. Six (6) Category6e Shielded Twisted Pair Cables, 50 Feet

4. Audio Playback Rack – Audio playback shall primarily consist of a Show Control Computer and Bluetooth Audio along with local analog I/O to the Audio Console. Networking switches are included The audio playback rack should contain the computer CPU, network switches, drawer storage, cable, and power management.

a. One (1) Show Control Computer

1) Basis of Design: Mac Mini MGNT3XX/A

a) 1 Terabyte Solid State Drive
b) 16 GB RAM
c) Wired Keyboard
d) Wired Mouse
e) 32 Inch 4k Display
f) 1 Thunderbolt to HDMI expansion
g) Dante Virtual Soundcard
h) QLab Pro License
i) CPU shall be Rack Mounted

b. One (1) Bluetooth Audio Interface

1) Basis of Design: Radial Engineering BT-Pro V2

c. Three (3) Dante Compatible 10-Port Network Switches

1) Basis of Design: Cisco CBS350-8T-E-2G

a) The switches shall be configured and identified for one each: Control Network, Dante Primary, and Dante Secondary

d. One (1) Portable Rack

1) Basis of Design: SKB Cases 1SKB-R8U
2) Provide integral power management with front LED lighting
3) Provide integral storage drawer

5. Production Communications – Provide a portable 2 channel production communications system.
   a. One (1) 2-Channel Production Communications Base Station
      1) Basis of Design: Clear-Com MS-702
   b. Two (2) 2-Channel Production Communications Belt Packs
      1) Basis of Design: Clear-Com RS-702
      2) Provide 6-Pin Adaptor per beltpack
   c. Four (4) 1-Channel Production Communications Belt Packs
      1) Basis of Design: Clear-Com RS-701
   d. Eight (8) Production Communications Headsets
      1) Basis of Design: Clear-Com CC-15
6. Wireless Microphones – A Four (4) channel wireless microphone package shall be provided with frequency- sharing transmitters, batteries, and charger to be incorporated into the Audio Playback Rack.
   a. One (1) Four (4) Channel Microphone Receiver
      1) Basis of Design: Shure ULXD4Q
   b. Four (4) Lavalier Transmitters with Microphone Elements
      1) Basis of Design: Shure ULXD1
   c. Four (4) Handheld Transmitters
      1) Basis of Design: Shure ULXD2/SM58
7. Assisted Listening System – Provide ADA Compliant Assisted Listening System
   a. One (1) Assisted Listening System
      1) Basis of Design: Listen Technologies LS-53-216
      2) Base station shall be housed in SVC Rack 2
8. Program Microphone – A permanently mounted stereo microphone shall be provided to provide program material to the Assisted Listening System, Dressing Room, and Outdoor Lobby.
   a. One (1) Program Microphone
      1) Basis of Design: Shure VP-88
9. Wired Microphone Package – Provide a compliment of loose wired microphones, cables, and microphone stands.
   a. Eight (8) Wired Vocal Microphones
      1) Basis of Design: Shure SM-58
   b. Eight (8) Wired Instrument Microphones
      1) Basis of Design: Shure SM-57
   c. One (1) Wired Kick Drum Microphone
      1) Basis of Design: AKG D112
   d. Two (2) Wired Condenser Microphones

1) Basis of Design: AKG 414

e. Thirty-two (32) Microphone Cables, XLR, 25'
f. Ten (10) Microphone Cables, XLR, 50'
g. Twenty (20) Microphone Stands, Tripod, Telescoping Boom

1) Basis of Design: K&M 210/9

h. Eight (8) Microphone Stands, Straight, Heavy Base

1) Basis of Design: K&M 260/1

10. Portable Video Equipment – Provide a portable video projector and projection screen.

a. Video Projector

1) Basis of Design: EPSON Pro Cinema 4050

b. Projection Screen

1) Basis of Design: Da-Lite Fast Fold Deluxe 88609

2.2 ANCILLARY SPACES TO ASSEMBLY (DRAMA ART) ROOM 116 :

A. Four ancillary spaces directly interact with the Assembly Room. They are as follows: Electrical Closet 121 where the bulk of the wire infrastructure and permanently installed equipment shall be located, Dressing Room 115 which houses a ceiling program loudspeaker and associated volume knob, the Open Air Lobby which has a series of four outdoor-rated program loudspeakers, and Utility Room 120 which houses some light infrastructure.

1. Electrical Closet 121

a. SVC Rack 2 – This rack shall serve as the primary termination location for infrastructure cabling and permanent installed equipment.

1) Basis of Design: Middle Atlantic WR-44-32
2) Provide pull out rack with integrated power and cable management.
3) The Electrical Contractor shall distribute power to the rack via junction boxes.
4) Equipment named above and below as being housed in this rack shall be installed.

b. Terminations – Provide custom or purpose ordered rack terminations for all wire and cable types routed to this rack. (Note: the Production Communications channels should be separately bussed throughout the project. I.e., all channel A intercom channels should be bussed together and all Channel B intercom channels should be bussed together)
c. Three (3) Dante Compatible 10-Port Network Switches

1) Basis of Design: Cisco CBS350-8T-E-2G

a) The switches shall be configured and identified for one each: Control Network, Dante Primary, and Dante Secondary

2. Dressing Room 115 – Provide a single channel program in-ceiling loudspeaker, associated volume controller, and amplification.

a. One (1) In-Ceiling Loudspeaker

1) Basis of Design: QSC-ADC4T-WH

b. One (1) Volume Control

1) Basis of Design: Atlas Sound VC-70V

c. One (1) Channel of Amplification at 70V

1) Amplifier may be used with a multi-channel 70V amplifier in conjunction with other 70V needs but it must remain on its own circuit.
2) Amplifier shall have Dante audio networking

3. Open Air Lobby– Provide four (4) single channel, surface mounted, program loudspeakers, volume control, and amplification.

a. Four (4) Surface Mount Loudspeaker

1) Basis of Design: QSC-ADS-4T
2) Refer to Architect Elevations for co-ordination

b. One (1) Volume Control

1) Basis of Design: Atlas Sound VC-70V
2) To be housed in SVC Rack 2

c. One (1) Channel of Amplification at 70V

1) Amplifier may be used with a multi-channel 70V amplifier in conjunction with other 70V needs but it must remain on its own circuit.
2) Amplifier shall have Dante audio networking

2.3 CLASSROOM (GENERAL) 108 :

A. This classroom will house a very basic Audio and Video presentation system comprising of two (2) surface mounted loudspeakers, a surface mount projection screen, and a ceiling mounted projector. Infrastructure between the wall of the classroom and the projector wall will provide video signal while networked audio through the SVC Rack 2 will provide audio signal.

1. Classroom (General) 108

a. Two (2) Surface Mount Loudspeaker

1) Basis of Design: QSC-ADS-4T
2) Refer to Architect Elevations for co-ordination

b. Two (2) Channels of Amplification at 8 Ohm

1) Amplifier may be used with a multi-channel 8Ohm / 70V amplifier in conjunction with other 70V needs but they must remain on their own circuits.
2) Amplifier shall have Dante audio networking

c. One (1) Analog Audio to Dante Network Converter

1) Basis of Design: DINET-DAN-TX

d. One (1) Projection Screen

1) Basis of Design: Da-Lite Model C 79043

e. One (1) Video Projector

1) Basis of Design: EPSON Pro Cinema 4050

f. One (1) Network Video Transceivers

1) Basis of Design: Kramer TP580 KIT

2.4 STUDY LABS ROOMS 125 AND 126 :

A. These study labs will function as “One Button Studios” where students may be able to record and edit their own multimedia presentations. As the technology is rapidly changing, the nominated contractor will need to suggest how best to accommodate the current standard, which can be found at: https://onebutton.psu.edu

1. Study Lab Room 125

a. One (1) One Button Classroom System

1) Basis of Design: https://onebutton.psu.edu

2. Study Lab Room 126

a. One (1) One Button Classroom System

1) Basis of Design: https://onebutton.psu.edu

2.5 CLASS LAB ROOM 129, SPECIAL CLASS LAB ROOMS 130 & 132, AV ROOM 131

A. At this time, this suite of rooms is scheduled as an infrastructure-only section of the project. SVC Rack 1 is scheduled to be installed, but space considerations may necessitate integrating with OFE and furniture. An allowance should be held for a potential rack and all patch bays associated with it.

1. AV Room 131

a. SVC Rack 1 – This rack shall serve as the primary termination location for infrastructure cabling.

1) Basis of Design: Middle Atlantic WR-44-32
2) Provide pull out rack with integrated power and cable management.
3) The Electrical Contractor shall distribute power to the rack via junction boxes.
4) Provide allowance for patch bays terminating all infrastructure cabling.

B.

PART 3 – EXECUTION

3.1 QUALITY ASSURANCE AND WORKMANSHIP

A. The Sound, Video & Communication System Contractor shall follow good working practices and fabricate and install items in accordance with the manufacturer’s recommendations and the Consultant’s specifications. Provide quality control procedures acceptable to the Owner and Consultant. Provide a properly qualified site supervisor who shall carry out supervision duties only. Provide straight, plumb, true and aligned components throughout, and shall consult with other trades doing related work and adjoining work in order to provide an installation of first-class quality.

B. The Consultant reserves the right to reject any part of the installation not in compliance with the Contract Documents. The Sound, Video & Communication System Contractor shall carry out any necessary remedial work or replacement free of charge and without delay to the Owner.

C. A standard reference guide for the design, engineering, and installation of the Sound, Video & Communication System shall be Audio System Design and Installation, by Philip Giddings (Sams Publishing).

3.2 DEFINITIONS

A. Electrical Reference:

1. The following electrical references are used throughout the Sound, Video & Communication System specification:

a. Voltage: dBv = 20log(E1/E2)
b. Power: dB = 10log(P1/P2)
c. 0dBu = 0.775VRMS; ratio of voltages measured open circuit
d. 0dBv = 0.775VRMS; ratio of voltages measured open circuit
e. 0dBV = 1.0VRMS; ratio of voltages measured open circuit
f. 0dBm = 1mW; power level (typically 0.775V into 600-ohm load)
g. 0VU = +4dBm; power level referenced to 600 ohms

B. Electrical Characteristics:

1. Unless otherwise specified in the Contract Documents, electrical characteristics of the Sound, Video & Communication System equipment shall be as follows:

a. Microphone preamplifier inputs shall be balanced, have an impedance greater than or equal to 1.2k ohms, and designed to be driven from sources of 600 ohms or less.
b. Line inputs shall be balanced bridging, have an impedance greater than or equal to 10k ohms, and designed to be driven from sources of 10k ohms or less.
c. Line outputs shall be balanced, have an impedance less than or equal to 100 ohms, and designed to drive loads of 600 ohms or greater.

C. Connector Polarity: Proper polarity of connectors on combination panels, receptacle plates, rack panels, patch panels, and other devices fabricated and/or wired by this Contractor shall be established as follows: Polarity of connectors for OEM devices and equipment may be different, and should be wired to patch panels so as to maintain consistent system polarity.

1. Microphone and Line Level

a. Balanced Connection

XLR-3 connectors: pin 1 = ground/shield (do not connect to case); pin 2 = high (“hot”); and pin 3 = low (“cold”).

¼” T/R/S phone connectors: sleeve = ground/shield; ring = low (“cold”); and tip = high (“hot”).

b. Unbalanced Connection

XLR-3 connectors: pin 1 = ground/common/shield (do not connect to case); pin 2 = high (“hot”); and pin 3 = tie to pin 1 only.

¼" T/S phone connectors: sleeve = ground/common/shield; and tip = high ("hot").

Phono (RCA) connectors: sleeve or shell = ground/common/ shield; and center pin = high ("hot").

2. Multiconductor Application

   a. Multipin connectors: Refer to the manufacturer's specifications.

3. Data Connection

   a. RJ45 connectors: Refer to the manufacturer's specifications.

4. Video and RF Level

   a. BNC-type connectors: sleeve or collar = ground/shield; and center pin = signal ("hot").

5. Low Impedance Loudspeaker Level

   a. Neutrik NL4 series connectors used for bi-amplified or passive (mono-amplified) Sound, Video & Communication System loudspeakers: pin "1+" = Low frequency or full-range driver "+"; pin "1-" = Low frequency or full-range driver "-"; pin "2+" = High frequency driver "+"; pin "2-" = High frequency driver "-".
   b. Neutrik NL4 series connectors used for 70.7 volt lines: pin "1+" = high ("hot"); pin "1-" = N/C; pin "2+" = N/C; and pin "2-" = low ("common").

D. Transducer Polarity: Proper polarity of electro-acoustic transducers shall be established as follows, with exceptions as noted:

1. Microphone

   a. Positive acoustic pressure on the microphone diaphragm produces a positive voltage on pin 2, with respect to pin 3 of the output connector.

2. Loudspeaker

   a. Positive voltage applied to the (+) terminal produces a displacement of the loudspeaker cone away from the magnet, thus producing a positive acoustic pressure.

3.3 INSTALLATION

A. General:

1. All equipment except portable equipment shall be securely held in place with a safety factor of at least three; except that all equipment rigged overhead shall be so done using safe rigging practices and with rated hardware selected to meet a safety factor of at least ten. All equipment shall be installed in such a fashion as to present no safety hazard to operating personnel.
2. All equipment shall be adequately ventilated when operating under worst-case power dissipation.
3. All metal cabinets connected to the Sound, Video & Communication System audio ground network shall be effectively isolated from any conduit or other metallic component that is connected to the building electrical safety ground.

4. All installation work shall be carried out in a neat and orderly fashion.

B. Wiring:

1. Ensure by drawing review and field survey that the conduit/raceway infrastructure is sufficient for the proper installation of the specified and required wire and cable, and/or any approved-substitute types of wire and cable.
2. Do not begin pulling Sound, Video & Communication System wiring through the Sound, Video & Communication System Empty Conduit System until all conduit, pull boxes, etc. for each given run (point-to-point) are completely installed by the Electrical Contractor and ready for such wire and cable installation. Undertake a field inspection of the conduit system and pull boxes, reporting any missing conduit, harp edges, missing bushings or drag lines, blocked runs, etc., prior to attempting installation of wire and cable.
3. The Sound, Video & Communication System Contractor shall ensure that the wire and cable is installed in a manner that shall neither cause nor permit damage to the wire and cable throughout the installation process. Damaged wire and cable (including wire and cable spliced in violation of specified requirements) shall be rejected and replaced by this Contractor at no cost to the Owner.
4. All microphone level, line level, video/RF level, Data level, low impedance loudspeaker level, and AC power level wiring shall be restricted to individual and separate conduit systems.
5. All microphone and line level wiring shall be balanced and floating, unless otherwise indicated.
6. Take all necessary precautions to prevent electromagnetic, electrostatic, and radio frequency interference.
7. Care should be taken in wiring and installation to prevent damage to wire or equipment. All wire entering racks or other equipment shall have a service loop of at least four (4) feet unused (slack) length after termination. This service loop shall be neatly bundled and harnessed in place.
8. No splices shall be allowed in microphone, line level, video/RF or data cables unless it is physically impossible to install the wire in one length. Splices must be approved by the Consultant on a case-by-case basis. When approved, the following splicing methods may be used:
    a. Crimp-type “butt” splice connectors with an appropriately sized shrink tube for each conductor, as well as an overall shrink tube for all audio and intercom cable types.
    b. Female BNC “barrel” connectors for video/RF cable. Male BNC connectors shall be provided on cable ends at location of the splice.
    c. Female 8P8C (commonly known as RJ45) “barrel” connectors for Data cable. Male 8P8C connectors shall be provided on cable ends at the location of the splice.
    d. Splices in loudspeaker cable are permitted without prior approval by the Consultant. Such splices shall be kept to a minimum.
    e. Any splices made shall occur only at junction boxes, pull boxes or other permanently accessible locations. Such splices shall be listed on a schedule provided with the as-built documentation.

C. Flexible Cords and Cables:

1. Flexible cords used shall be selected giving consideration to ambient and conductor temperatures, wear-resistance, flexing, and mechanical

stress. Vulcanized rubber, butyl rubber, EP, or silicone rubber insulated cables shall be used in preference to PVC insulated types, wherever possible. All flexible cords and cables shall comply with the current edition of the applicable local Electrical Codes and appropriate regulations as identified in “Part 1 - General: Safety and Code Requirements”.

2. Flexible cables used as hanging or trailing leads, for power or control circuits, shall comply with the previous clause and shall, if under tension, be fitted with a strain-relief center core that shall be clamped at both ends to relieve the strain on conductors. Trailing leads shall be of a suitable length for the actual application.
3. The segregation of conductors carrying different category circuits shall be as defined in the applicable regulations (local, state and national Electrical Codes and elsewhere herein) and shall be maintained in all flexible cables used. Adequate insulation shall be ensured on all multicore and control circuits.
4. Where the final connection to any equipment is by means of a flexible cable, such flexible cable shall have the same current rating as the rest of the circuit. The current ratings for the ambient temperature shall be as given in the applicable local Electrical Code.

D. Labeling and Marking:

1. All Sound, Video & Communication System wire and cable shall be logically and permanently marked by the Sound, Video & Communication System Contractor. All wire shall be identified at each termination point, and shall be marked to indicate the discrete destination (i.e., a wire shall show the reference number of the jack or connector to which its other end is terminated). All cable markers shall bear the alphanumeric characters of the circuit shown on the approved shop drawings.
2. Wire and cable shall be marked with an approved system of durable identification markers, such as slip-on type PVC or neoprene sleeves, or with directly heat stamped characters. The use of computer-generated labeling systems, such as the Brady DAT-34 or DAT-37, is recommended. Cloth, vinyl or P-Touch tape-type markers are not acceptable.
3. The individual pairs of multipair cable and individual conductors of multiconductor cable shall be readily identified by permanent color coding of the wire insulation. Multipair or multiconductor cable that is identified only by means of the form or order of lay of individual wire is not acceptable.
4. All spare wire shall be marked “spare” at both ends and numbered consecutively. A “spare schedule” shall be provided indicating spare wire and cable numbers, locations and types.

E. Termination:

1. All connections and joints shall be made with rosin-core solder or an approved mechanical connector.
2. All multipin connectors shall have crimp-type gold-plated contacts.
3. All Contactor-terminated data cables & connections must be “certified” using industry-standard testing and verification equipment.
4. Where flexible cable joins fixed wiring the terminations shall be accomplished with either a pair of appropriate mating connectors or a suitable terminal block.
5. All terminations of shielded cables shall consist of a PVC or neoprene heat shrink sleeve covering the shield drain wire and an overall PVC or

neoprene heat shrink sleeve covering the point at which the cable jacket and shield end.

F. Audio Grounding:

1. All shielded cables shall have their shields isolated from both the conduit system and any other shielded cables. Shields shall be continuous from source to input points. Shields shall be connected at input points only, with shields lifted at the source, except as noted below.
2. Microphone wiring shall have continuous shields from the microphone receptacle to microphone patch jack.
3. Tie-line patch points shall have continuous shield connection from one patch jack to another with no permanent connection to the audio ground network.
4. Unbalanced wiring, such as used in certain communication systems, shall have audio shields connected at device inputs and floated at device outputs. Strap shield to “low” side of unbalanced input.
5. No “doubling up” of ground points on multipin connectors or terminal blocks shall be allowed.

G. AC Power System:

1. AC power for the Sound, Video & Communication System, provided by the Electrical Contractor, is distributed at 120VAC, 60Hz. Refer to the electrical plans for further information.

H. Grounding:

1. The Sound, Video & Communication System audio ground network (“audio ground”), including ground source, ground conductors, and ground distribution points is provided by the Electrical Contractor. The isolation and ground continuity of this network, although the responsibility of the Electrical Contractor, shall be confirmed by the Sound, Video & Communication System Contractor prior to installation of equipment. Any ground shorts or faults shall be reported for correction by the Electrical Contractor.
2. The audio ground network shall be isolated from all other electrical grounds except at the source of the ground network, the building safety ground, specified to be of high quality. Therefore, if the connection between the audio ground network and the source of the ground is disconnected, no continuity between the audio ground and the building electrical ground shall exist.
3. The Sound, Video & Communication System audio ground network connects all Sound, Video & Communication System equipment positions together by a single, low impedance, ground network. All AC power wall receptacles in Sound, Video & Communication System areas, provided by the Electrical Contractor unless otherwise indicated, will be the isolated ground type, connected only to the associated audio ground spur in that area.
4. All Sound, Video & Communication System equipment racks containing active electronics shall be connected to the audio ground network, except as otherwise noted in this specification. Caution must be exercised so that these racks are not permanently, or in any way during operation, capable of being accidentally connected to the building safety ground.
5. All conduits and back boxes containing Sound, Video & Communication System wiring shall be permanently connected to the building electrical safety ground.

6. Video (RF) and infrared (RF) devices, being unbalanced in nature, shall not be connected to the Sound, Video & Communication System audio ground network.

I. Electrical Safety:

1. No voltage in excess of 25V rms AC or 24V ripple free DC shall be exposed to touch in normal use or in any equipment by the withdrawal of modules or of any plug or connector or without the removal of suitably indelibly labeled covers.
2. Unless specifically excepted, all live electrical parts above 50V rms AC or 60V ripple free DC, including terminals, shall remain completely shrouded by insulation or grounded metal when the main access panels are removed. The separate shrouds or covers shall require a tool to remove them to prevent inadvertent contact with live parts.
3. In addition, where enclosures or items of equipment containing predominantly control, computer, or similar low voltage signals also contain voltages in excess of 50V rms AC or 60V ripple free DC, clear standard warning notices indicating the maximum voltage present shall be provided on all removable access panels. Similar warning notices shall be provided where voltages exceeding 120V are present in any enclosure or item of equipment and such a voltage would not reasonably be expected to be present.
4. Within enclosures, racks and panels identify with prominent, standard, and indelible signage, which circuit breakers or disconnects are to be switched off in order to isolate the equipment totally. Warning notices shall also be provided on all equipment that contains live terminals after operation of its circuit breaker or disconnect. These terminals must be completely shrouded to prevent inadvertent contact.
5. All equipment, control stations, equipment racks, enclosures, and all metal cases, raceways, and conduit shall be efficiently grounded. Special hand held or portable equipment that is not double insulated shall have duplicated grounding connections. All grounding shall be in accordance with the current edition of the applicable local, state and national Electrical Codes and as identified within this Section and Division 13.

J. Control System Voltage:

1. Control circuits shall generally be operated at a maximum of 24V AC or DC as appropriate, and in compliance with the protection described. Hand held control panels shall not contain line (120V) voltage unless approved. Special arrangements to feed movable panels with both line voltage and control voltage must provide suitable mechanical protection and ensure separation of services using the correct category of cable as defined in the codes and regulations identified in “Part 1 - General: Safety and Code Requirements”.

K. Equipment:

1. Operating parts of all equipment shall be suitably machined and finished. Tolerances, fits, finishes, etc., where not specified herein or indicated on the drawings, shall conform to best trade practices and the operational intent of the equipment.
2. All components shall be of new or recent manufacture, built within two (2) years of the date of installation and never used prior to installation.
3. All components and items used in Sound, Video & Communication System shall be by a recognized manufacturer specializing in

professional Sound and electrical equipment and shall conform to applicable industry and code standards.

4. The quality of workmanship and materials of all equipment and components requiring custom fabrication shall be comparable to that of professional audio equipment as produced by specialized original equipment manufacturers.
5. All components used in the equipment installations shall be selected on the basis that each item, or a similarly performing substitute, will be obtainable by the Owner for a period of five (5) years should further spares be required.
6. All electronic components shall be readily available from at least two recognized manufacturers.
7. Custom firmware (EPROM, ROM, etc.) shall be supported by readily available spares.
8. All equipment forming part of a given system or installation, and all like components, spares and replacements shall be electrically and mechanically interchangeable.
9. Electrical and electronic components shall be selected for long operating life and reliability. The design of components and assemblies shall ensure that all such components work at a minimum of 25% less than their maximum ratings.
10. All integrated circuits containing program code and all circuits with twenty four or more pins shall be mounted in sockets.
11. All indicators, controls, fuses, relays, contactors, printed circuit cards, and other major components shall each be fitted with a permanent label indicating their type, rating, and duty to expedite any necessary replacement or fault finding. Where applicable, a means of identifying normally open, normally closed, and other contact configurations shall be marked on the component.
12. Annunciators, indicators, and fuses in individual power and electronic systems shall be standardized and approved by the Consultant before design is finalized. Indicating devices shall be of as few different types as possible and wherever practicable shall have a minimum life of 10,000 hours.
13. All contactors and relays (although not necessarily special approved types such as reed relays) shall be of the snap-track type developed for mounting inside equipment rack. Generally the contact rating shall be twice the expected maximum operating or inrush current whichever is the greater.
14. Fuses and circuit breakers shall be panel mounted. Fuses shall be mounted in indicating fuse holders, illuminated when the fuse has failed. Where fuses must be concealed they shall be easily accessible. All panels with concealed fuses shall be marked accordingly on the outside and shall have panel mounted indicator lights. Spare fuses shall be provided in holders mounted within the panel.
15. All internal switches shall be clearly and permanently labeled.
16. All connectors external to the equipment shall be of rugged metal construction with self-contained locking devices. Nonmetallic external connector shells are unacceptable.
17. All keyswitches and keylocks for similar components shall use the same key. Unless otherwise specified, keys shall be removable in all positions. Supply four (4) key copies for each keyswitch/keylock.
18. All edge connectors, ribbon cable connectors and headers shall have gold-plated contacts. All IC sockets shall be of a face-wipe, gas-tight design.

L. Assemblies:

1. Manufacturing, assembly, and wiring work shall be carried out by trained and experienced technicians.
2. Ensure that all parts and components of electrical, electronic, or computer installations are readily accessible for inspection, service, and maintenance. All components shall be replaceable without removal of operational components other than those mounted on or carrying the faulty component. All parts shall be replaceable without strain or damage to other parts.
3. Electrical and electronic systems shall be constructed as separately removable modules. Where a system comprises a large number of similar modules, these modules shall be designed so as to be easily interchangeable. Where such equipment is of a plug-in type, withdrawing or replacing the modules with the power “on” shall not cause damage to the units or to other equipment.
4. Electrically dissimilar modules or connectors shall not be able to be wrongly connected. Operating surfaces of control panels/consoles shall be of steel, aluminum, or other rigid material, reinforced where necessary to prevent noticeable panel deflection. Generally, all sides of a control panel shall be fully supported.
5. Where possible all control and connection panels shall have hinging or drawer access to electronics for installation and maintenance. Panels shall be held closed by captive quick locking hardware. Provide terminal strips, and neatly bundled wiring to facilitate access. Captive fasteners shall be provided for all removable panels or parts. Any inaccessible nuts shall be fixed. Countersunk or instrument head screws shall be used on external surfaces.

M. Custom Fabrication:

1. Particular attention shall be paid to the selection of operational components used on custom pendants and control panels. All such components shall be selected for long life under arduous conditions, including rough use in a dusty and dirty environment.
2. Pushbuttons, selector switches, key switches, operating knobs, handles, and similar shall all be rugged industrial-type components, firmly mounted and capable of giving long trouble-free service. Commercial-grade units will not be accepted.

N. Finishes:

1. Unless otherwise indicated, all steel equipment cabinets and panels shall be finished with one coat of primer and two coats of semi-gloss baked enamel after full degreasing and rust preventing processes. Colors shall be as selected by the Consultant or as specified herein.
2. Aluminum panel surfaces shall be anodized black or other color as indicated herein or on the drawings.
3. Finishes subjected to high temperatures shall be of heat-resistant epoxy or other durable high-temperature baked-on enamel finish.
4. Finishes shall be durable and capable of withstanding normal usage in the areas in which they are installed.

O. Equipment Racks:

1. All internal wiring of electrical, electronic or computer equipment shall be in accordance with the current editions of the applicable Electrical Code

and governing regulations as identified in “Part 1 - General: Safety and Code Requirements”.

2. All internal wiring shall be of adequate mechanical strength as well as electrical current rating. Multistrand cables shall be used for low current wiring in preference to solid conductors. The current carrying capacity of all cables within equipment enclosures shall take account of de-rating factors and ambient temperatures in accordance with applicable local, state and national Electrical Code regulations.
3. All terminal strips shall be logically positioned and indelibly marked in accordance with the circuit drawings. Generous space shall be left for installation of the external cables.
4. All terminals, to which connections are to be made by Division 16, shall have clear markings that are unique for each terminal and are as identified on the shop drawings.
5. All internal wiring shall be color coded and contained within raceways. At least 40% space shall be available as initial spare capacity. All the conductors of a given power circuit shall be contained within the same conduit or raceway. All internal wiring shall be protected from mechanical damage.

P. Labeling:

1. All wall receptacle plates shall be engraved and filled to indicate the reference number of the circuit to which each is attached. Such numbers will, when applicable, be referenced to the patch panel jack to which the circuit connects. Refer to the contract drawings for reference numbers and designations.
2. Panels and receptacles must be readable in dim lighting. Quality of engraving and filling, letter sizes, etc. shall comply with “Part 2 – Products: Receptacle Plates” of this specification and as approved by the Consultant through shop drawing and sample submittal.
3. All legends shall be engraved and filled in a color as indicated on the drawings, unless otherwise noted below.
4. Where required, engraved, adhesive-backed lamacoid labels shall also be mechanically fixed in place only in those cases where there is no risk of damage to a device’s internal components or wiring.

Q. Noise from Equipment

1. The residual noise and hum output of the systems shall be such that PNC-15 or below can be measured at the center of main floor, and the character of the remaining noise must be random, with no audible discrete frequency components.
2. Where a control panel or rack is to be used or located in an operational area, such as on stage, a gallery, or control room, there shall be no acoustic noise associated with the panel. No internal cooling fans or similar moving or magnetic equipment shall be permitted unless approved by the Consultant in writing.
3. Operation of switches, pushbuttons, relays, solenoids, and similar shall not be audible to members of the audience (even in the control rooms with the window open).

R. Spare Parts

1. Supply spare parts to be stored on-site for all user serviceable equipment and systems. A sufficient quantity of bulbs, fuses, knobs, switches, and other miscellaneous parts shall be supplied. Refer to “Part 2 - Products” for spares of electronic and transducer parts to be supplied.

2. Label all spare parts with manufacturer's part number, designation, description, and location(s) where part is used. Provide neatly labeled storage containers for all spare parts, including special static free wrapping for electronically sensitive parts.
3. The spare parts shall be released to the Owner after completion of the commissioning procedure.

S. Site Work

1. The Sound, Video & Communication System Contractor shall be responsible for delivery, storage and handling of equipment and tools during the period of the installation.

T. Painting

1. Except for special requirements as approved by the Consultant, each painting system shall use paint products of one manufacturer to ensure compatibility of primer and undercoat with top coats.
2. All paint products shall be factory prepared of the best grade and quality (front line) produced by the manufacturers, subject to approval by the Consultant.
3. Finish coats on components exposed to view at all locations shall be two (2) coats of approved finish.
4. The Sound, Video & Communication System Contractor shall be held wholly responsible for the finished appearance of the painting work. Painting will be in accordance with the highest standards of the trade.
5. All components exposed to view shall be shop painted to match approved samples.
6. Re-touch all shop painted or finished work wherever necessary or as directed, including unpainted screws and other fasteners. Prime paint all patched portions in addition to all other specified coats.

U. Protection Of Work

1. Shipping and Storage

   a. The Sound, Video & Communication System Contractor shall be responsible for the satisfactory packing and protection of all components and materials for shipment from the factory to the site. Any items suffering damage during transit due to unsatisfactory packing shall be replaced without charge to the Owner.
   b. All equipment shall be packed to withstand the intended method of transport and environmental conditions expected. This Contractor shall take full account of the effects of rough handling, temperature extremes, dust, heavy rain, direct sunlight, and high relative humidity (up to 99%) during transit and installation. The packing shall, where necessary, reduce the effects of condensation.
   c. All equipment shall be packed in sturdy containers to provide mechanical protection during shipping and storage. Provide padding, etc., as necessary to protect the equipment from vibration and shock.
   d. Inner plastic sheeting shall be provided to protect the equipment from moisture and dust. Such covers shall be kept on equipment until environmental conditions have stabilized and the installation areas have been completed.

e. No equipment shall be shipped to the job site by this Contractor until notification by the Contractor that storage facilities are available to protect the equipment prior to installation.

f. The Sound, Video & Communication System Contractor shall be responsible for storage and protection of portable equipment and components until turning these items over to the Owner during commissioning. Instruct the Owner as to the proper method of storage and protection of the equipment during installation.

g. Refer also to the General Conditions, as amended by the Supplementary Conditions.

2. Installation

a. Installation shall be authorized only when site conditions provide mechanical, electrical, and environmental protection suitable for the electronic equipment.

3. Special Protection of Electronic Equipment and Cable

a. This Contractor shall conform with the following minimum standards and procedures for the storage and protection of the equipment during installation:

b. Class 1 - Cable and distribution apparatus, back boxes, face plates, terminal boxes, and rack frames may be stored and installed in weather-protected spaces under “normal” construction site conditions provided that no electronic components are contained within devices and provided that storage boxes are sturdy, well sealed, and devices are protected with imperforate inner plastic sheeting. When installed, devices must be protected from dirt, dust and moisture by sturdy impermeable plastic sheeting, and completely covered with heavy corrugated cardboard, held in place securely by duct tape. Covers shall not be removed until the area is broom cleaned. Care shall be taken to prevent damage and prolonged exposure to improper site conditions during installation. In no case shall devices remain uncovered overnight during installation or while work is taking place causing high dirt dust or moisture levels in the area of placement.

c. Class 2 - Control panels, spare parts, and test equipment (except as listed under Class 3) shall be protected and treated as per the Class 1 devices with the following additional provisions: Equipment shall be stored in an air-conditioned secure space. Equipment shall not be shipped until such space exists on site and is approved by the Consultant and Contractor. Control panels with electronic components may be installed providing they are protected as described under Class 1 description above, but electronic components must be removed and shall not be installed until the area of installation is broom cleaned and all dirt, dust and moisture producing work is completed in the area. All other equipment in this class shall not be installed until the area of installation is broom cleaned, “blown” clean with pressurized air, mopped, secure, and air conditioned.

d. Class 3 - Mixing consoles, filled equipment racks, and other electronic equipment shall not be shipped to site until the control rooms are finished, air conditioned, dust free, broom and mop cleaned, secure, and in all respects complete and ready for

occupation. This class of equipment shall not be unpacked until the system is complete in all other respects. Under no circumstances may any equipment in this class be removed from the control rooms into or through spaces that are not cleaned, air conditioned, and complete.

3.4 TESTING AND ADJUSTMENT

A. General

1. Perform tests and adjustments to the Sound, Video & Communication System as outlined in this specification. These tests and adjustments shall be completed at the time(s) specifically indicated in “Part 1 - General: Commissioning.”
2. Provide a minimum of two qualified technicians to assist in tests, adjustments, and final modifications during the testing and adjustment period.

B. Preparation

1. Ensure that all equipment racks, panels, and back boxes have been adequately cleaned of dirt, dust, and debris. Reassemble all equipment and replace all panels and covers with the necessary screws and/or other appropriate hardware prior to the final site inspection.
2. Before applying AC power to Sound, Video & Communication System equipment, perform a complete system inspection on the site to verify that all items are correctly installed and will operate safely as specified in the Contract Documents.
3. Verify also that each individual section of the Sound, Video & Communication System has been correctly installed and is fully operational.

C. Conditions

1. Do not use any major control equipment intended for installation in the Sound, Video & Communication System for the purpose of checking or testing wiring or circuitry until such time as requirements for “Class 3” equipment meet the environmental conditions described in “Special Protection of Electronic Equipment and Cable” above. Provide testing apparatus, substitute control equipment, or other devices for testing wiring and circuitry prior to the existence of these conditions at all locations of Sound, Video & Communication System equipment.
2. Electroacoustic measurements shall only be made once all interior room finishes are completed and all performance equipment is in place and operational. Such equipment includes, but is not necessarily limited to, audience chamber seating, acoustic isolation doors, acoustic canopies, and acoustic control curtains and banners.

D. Test Equipment

1. The following test equipment, provided at the expense of the Sound, Video & Communication System Contractor, shall be available on site during all testing and adjustment sessions, initial and final site inspections, and demonstration and instruction sessions. Provide all appropriate monitors, adapters, cables, and connectors necessary to interconnect the test equipment devices to each other and to the Sound, Video & Communication System equipment.

    a. Multi-Function Audio Signal Generator/Analyzer

1) Neutrik Minirator MR2 / Minilyzer ML1, or approved equal

b. Digital Multimeter

1) Fluke 77 IV Series, or approved equal.

c. Polarity Testing System

1) LA Audio PC90 or approved equal

d. Impedance Meter

1) Goldline ZM-1, or approved equal.

e. Sound Level Meter

1) MiniAnylyzer, approved equal

f. Two-channel FFT-Based Electroacoustic Analysis System

1) SIA SMAART
2) General: Computer-based electroacoustic measurement system requiring proprietary equipment and a certified operator. Provides dual-channel FFT transfer- function measurements, phase response, delay locator and real-time analysis and ability to perform these measurements with test signals and with program (music) occurring during performances.

g. Two-Way Radios

1) Motorola UHF, or approved equal.
2) Quantity: Six (6) , with spare battery & charger.

2. Requests for alternate test equipment shall be submitted to the Consultant for approval shall meet or exceed the manufacturers' published specifications for the above components. No exceptions. Nonprofessional test equipment, including "custom-built" components, shall not be acceptable.

E. Procedure:

1. Perform the following tests and adjustments to the Sound, Video & Communication System. All test results and system adjustments shall be fully documented for inclusion in the Initial and Final Test Reports. Refer to "Part 1 - General: Commissioning".
2. Continuity

a. All permanent Sound, Video & Communication System wire and cable shall be tested for continuity after installation in conduit and before termination in panels or racks. Also test for shorting contact between any and all conductors in a multipair or multiconductor cable and between each conductor and the conduit (building safety ground). Use a continuity meter for all tests.
b. All Sound, Video & Communication System wirepaths shall be tested to ensure that device inputs and outputs, assigned to particular circuits or channels, terminate to the correct location, and that all corresponding labeling is accurate.
c. Measure and verify electrical and electroacoustic polarity of all Sound, Video & Communication System components to ensure that the entire system is properly connected (i.e., the system

shall be “in phase”). Ensure that absolute polarity is maintained throughout all signal paths, regardless of patching or other routing changes.

d. Document all wiring or termination changes made in order to maintain system polarity.

3. Impedance

a. Measure and document the impedance of each microphone and line level line terminated with a 600-ohm 1% precision resistor, at 250Hz, 1kHz, and 4kHz, while disconnected from any device input. The load impedance value shall be greater than the resistive load.

b. Measure and document the impedance of each low-impedance loudspeaker line to an unconnected receptacle, at the patch panel, terminated at the opposite end with an 8-ohm 1% precision resistor, at 250Hz, 1kHz, and 4kHz, while disconnected from any device input. The load impedance value shall be greater than the resistive load.

c. Measure and document the impedance of each low-impedance (nominal 2 to 8-ohm) loudspeaker line while disconnected from the power amplifier. The load impedance value shall be greater than the total rated impedance of all connected loudspeaker drivers.

d. Test each full-range loudspeaker line at 63Hz, 250Hz, 1kHz, 4kHz, 8kHz, and 16kHz.

e. Test each band-limited loudspeaker line (i.e., bi-, tri-, or quad-amp systems) at the maximum number of test frequencies that fall within the frequency range of the driver under test.

f. Measure and document the impedance of each 70.7V loudspeaker line at 250Hz, 1kHz, 4kHz, and 8kHz, while disconnected from the power amplifier. The load impedance value shall be greater than the total rated impedance of all connected voice-coil transformers.

4. Radio Frequency Interference

a. Use a minimum 60 MHz bandwidth analyzer in conjunction with loudspeaker or infrared receiver/headset monitoring to ensure that the Sound, Video & Communication System under test is free of spurious oscillation and radio frequency interference (RFI). Measure and document all results.

5. Gain Structure

a. Set and document input and output gain controls on all Sound, Video & Communication System components to provide appropriate signal balance (i.e. unity gain) and optimum signal-to-noise ratio for each signal path. Unity gain shall be set by adjusting the gain of each active device (excluding power amplifiers and mixer/amplifiers) for input level equals output level by using a reference signal of 0dBv pink noise at the mixing console output.

b. Ensure that a minimum of 18dB of headroom exists for each gain stage. The overall system gain (excluding mixer/preamplifiers, mixer/amplifiers, and power amplifiers) through any signal path from any input to any output shall be unity + 1.5dBv.

c. Conduct listening tests from center of coverage of each high-frequency horn device to determine that there is no audible hiss or distortion.

6. Electronic Signal Path

a. Measure and document frequency response, signal to noise ratio (S/N), maximum output before clipping, total harmonic distortion (THD), and any spurious noise and/or hum signals of all electronic components in the Sound, Video & Communication System. Measured values must be as published by the manufacturer, or better.

b. With unity gain levels set, measure and document electrical frequency response for all discrete signal paths from the mixer through each active device, including mixer/amplifier outputs with the loudspeaker lines disconnected. Also test typical signal paths through each combination of mixer input to output. Use a -60dBv (0.8mV RMS) sine wave signal at microphone inputs from 20Hz to 20kHz and a 0dBv (0.775 VRMS) sine wave signal from 20Hz to 20kHz at line level inputs. Deviation shall be within +/-1.0dBv from the range of 30Hz to 20kHz, or the specified bandpass for a particular circuit. (Refer to manufacturers' published data).

c. With unity gain levels set, measure and document signal to noise ratio for all discrete signal paths from the mixer through each active device with mixer input shorted.

d. Measure and document maximum output before clipping (headroom) and total harmonic distortion of each active device with methods recommended by the equipment manufacturer.

e. With unity gain levels set, measure and document any spurious noise and hum signals such as 60Hz, 120Hz with harmonics, high frequency oscillation, clicks, pops, or noise spikes for all discrete signal paths from the mixer through each active device, including the mixer/amplifier outputs with loudspeaker lines disconnected. If any unwanted signals are detected, troubleshoot and correct or modify as necessary.

7. Power Output

a. Measure and document the output power of each power amplifier and mixer/amplifier, using a sine wave oscillator with less than 0.5% THD as an input source. Terminate each power amplifier channel output with a load resistor to match the nominal loudspeaker impedance. Apply a 1KHz signal at a level to achieve 10 dB below full rated power output of the mixer/amplifier. Observe the sine wave with an oscilloscope to insure that full voltage for rated power can be reached without noticeable deformation of the waveform.

8. Buzzes, Rattles, Distortion

a. Apply a sine wave sweep at a slow rate from 30Hz to 10kHz at 6dB below full rated power output of each amplifier in the Sound, Video & Communication System with output connections made to all loudspeaker drivers or voice-coil transformers. Adjust test frequency range to compensate for band-limited low-voltage loudspeaker lines (i.e., bi-, tri-, or quad-amp circuits) or 70.7 volt loudspeaker lines. Listen carefully to each loudspeaker for

electromechanical buzzes, rattles, distortion, or other objectionable noises and correct all causes of such defects. If cause is outside Sound, Video & Communication System equipment and/or the scope of this section of the contract, promptly notify the Owner and Consultant of the cause and suggested corrective procedure.

F. Sound, Video & Communication System Testing

1. The following Sound, Video & Communication System Tests shall be conducted as part of the SMAART measurement and optimization process. Sound, Video & Communication System Testing will require two 8-hour sessions scheduled to ensure quiet ambient noise levels in the test area. The Sound, Video & Communication System Contractor shall provide a certified SMAART technician to operate the SMAART System.

a. Sound Pressure Level: Measure and document sound pressure level of loudspeaker arrays throughout the seating areas and adjust suspended loudspeaker aiming, as necessary, to achieve a coverage of +/- 3dB, or better, with a peak continuous level of 105dB SPL. Take all readings at seated ear level height.

b. Loudspeaker Array Driver Alignment: Measure and document the loudspeaker driver alignment of the components of each loudspeaker array. Adjust precision signal delay units as necessary to achieve the best average signal alignment between adjacent components.

c. Frequency Response: Measure and document the frequency response of each loudspeaker array, as measured in both the reverberant field and near field (with windowed FFT methods), to ensure that the frequency response is within +/-3dB from 100Hz to 3kHz, and rolls off at a rate of 3dB/octave +/-3dB from 3kHz to 12kHz (and beyond, if possible). Apply the pink noise source at a line input of the mixing console. Adjust fixed Sound, Video & Communication System equalization as necessary. If discrepancies arise, the final curve shall be based on the average of the values measured. Hard copy documentation shall be recorded for both time-energy-frequency analysis and ISO one- third octave band frequency response measurement.

d. Speech Intelligibility: Perform subjective and/or objective speech intelligibility measurements or surveys throughout the facility and make adjustments as necessary to the Sound, Video & Communication System for maximum speech intelligibility. Submit proposed methods of testing to the Consultant for approval.

3.5 PROGRAMMING

A. At the completion of the Testing process, and in conjunction with the Consultant, Project Architect and Design Team, and other trades, the Sound, Video & Communication System Contractor shall provide full time technical support for ten (10) 12-hour days of Ride Programming. Two (2) technicians shall be provided for the entire duration of the Programming period.

B. Technical personnel should be prepared to adjust loudspeaker positions, facilitate required changes to Sound, Video & Communication System equipment

programming, and troubleshoot any technical problems that may arise during Ride Programming Sessions.

END OF SECTION

ADDENDUM A

SVC NARRATIVE AND EQUIPMENT

27 51 17- CONVERGED IP PUBLIC ADDRESS AND INTERCOMMUNICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Installation of all components, and configuration necessary for the complete installation and functionality of a fully tested and operational IP Converged public address and intercommunication system.

B. The system shall include all call paging access from the VoIP Telephone system, access to individual speaker, zone paging, all calls, other rooms, etc. System shall also provide for interfacing with the clock system for a class change signaling system and Fire Alarm system with override of PA tone signaling capability. The clock system shall include IP based NTP or master clock.

1.02 RELATED SECTIONS

A. Applicable Division 1 sections

B. Section 00 70 00: General Conditions

C. Section 01 77 00: Contract Closeout

D. Section 21 23 23: Excavating, Backfilling and Compacting for Utilities

E. Section 06 10 00: Rough Carpentry

F. Section 26 05 00: Common Works Results for Electrical

G. Section 26 05 13: Basic Electrical Materials and Methods.

H. Section 26 05 26: Grounding and Bonding

I. Section 26 05 33: Raceways and Boxes Fittings and Supports.

J. Section 26 24 16: Panelboards and Signal Terminal Cabinets

K. Section 27 01 26: Test and Acceptance Requirements for Structured Cabling

L. Section 27 05 36: Cable Trays for Communications

M. Section 27 10 14: Structured Cabling - new construction

N. Section 27 10 15: Premises Wiring for Convergence of Communication Systems

O. Section 27 51 29: Autonomous PA Sound System

P. Section 28 31 00: Fire Detection Alarm

1.03 REFERENCES

A. Electronics Industries Alliance (EIA):

1. EIA 160 Sound Systems

2. EIA-101 Amplifiers for Sound Equipment

3. EIA/TIA-568: Commercial building telecommunications wiring standard.

4. EIA/TIA-569: Commercial building standard for telecommunications pathways and spaces.

5. EIA/TIA-606: Administration standard for telecommunications infrastructure of commercial buildings.

6. EIA/TIA-607: Commercial building grounding and bonding requirements for telecommunications.

7. IEEE 802.3af or 802.3at: Standard for Internet

B. California Electrical and Fire Codes.

C. Building Industry Consultant Service International (BICSI):

1. Telecommunications Distribution Methods Manual

D. Federal Trade Commission (FTC):

1. Green Guides, 16 CFR Part 260, Guides for the Use of Environmental Marketing Claims.

E. Underwriters Laboratory listings and other labels

1. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.

2. ANSI/UL 2900-2-1, Standard for Software Cybersecurity for Network-Connectable Products.

1.04 SUBMITTALS

A. Provide the following submittals in accordance with Division 01:

1. Materials list: Submit a complete material list for the materials and products of this section.

2. Product Data: Include Product Data sheets and/or catalog cut sheets for all items to be installed. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data. Items shall be arranged in the same order as the index and if more than one item is indicated, the submitted items shall be highlighted or marked with an arrow. Product Data shall be sufficiently detailed to allow the ARCHITECT to review the product and to allow other trades to provide necessary coordination.

3. CONTRACTOR shall include in the Product Data list submission, copies of manufacturer certificates that the CONTRACTOR is an authorized distributor of the

submitted manufacturer's products; and each member of the installation crew has been trained and certified in the installation of those products. CONTRACTOR shall submit proof that his/her company has a service organization capable of responding within 24 hours of receipt of written notification and resolution within 1 day.

B. Shop Drawings: CONTRACTOR provided Shop Drawings shall indicate the following:

1. Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of devices and components, and complete details of method of fitting suspension and fastening devices in place. Provide wiring diagrams. Drawings shall contain enough information to assemble and install equipment at the Project site without further instructions.

2. Provide, drawn to scale, details of racks, consoles and cabinets with designations, elevations, dimensions, doors, barriers, mounting details, catalog number of locks, finishes and color.

3. Provide a dimensioned detail of console nameplate including school name, address, and power load. Indicate manufacturer's part numbers for all controls, switches, connectors and indicators.

4. Provide a complete sets of drawings of wiring diagram for each rack, instrument wiring and schematic diagrams of circuits of all equipment.

5. Provide detailed drawings as to interfaces with equipment furnished by others including number of wires, termination requirements, input/output voltages, input/output signals and other required coordination items, items including point to point connection details for all devices and equipment,

6. Shop drawings shall indicate equipment locations, wiring and schematics, details, configurations, sizes and a point-to-point wiring diagram of all components. Shop drawings shall indicate interfaces to equipment furnished by others, identifying termination interface requirements, and other specific details.

7. Provide one set of full-size shop drawings, in the same size as the Record Drawings, and 3 USB flash drive electronic copies.

8. Shop Drawings shall be prepared in the latest version of Windows compatible AutoCAD.

9. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.

C. Sample Materials: CONTRACTOR shall provide samples of material and equipment as required by the ARCHITECT. If samples are requested, they shall be submitted within 10 days from the date of request.

D. Sound calculations: Submit calculations of sound distribution and dB levels.

E. Certified Statements: CONTRACTOR shall provide the following certification statements:

1. CONTRACTOR shall provide a letter from the Manufacturer assuring the availability of spare parts common to proposed system for a period no less than 5 years on all components.

2. Certification of compliance with the California Health and Safety Code requirements for products containing substances identified in the California Lighting Efficiency and Toxics Reduction Act. These materials shall not exceed the following allowed content in parts per million (ppm):

   a. Lead content > 0.1% or 1000 ppm.

   b. Mercury Content > 0.1% or 1000 ppm.

   c. Cadmium Content > 0.01% or 100 ppm.

   d. Hexavalent Chromium > 0.1% or 1000 ppm.

   e. Polybrominated Biphenyls > 0.1% or 1000 ppm.

   f. Polybrominated Biphenyls Ether > 0.1% or 1000 ppm.

1.05 SUBSTITUTIONS

A. Equipment and materials that deviate from these requirements shall not be accepted without written approval from OWNER'S project manager. When deviating or substituting equipment, the following information shall be submitted:

   1. Substitution request form substantiating reasons and benefits to OWNER.

   2. OWNER'S approval shall be obtained for any equipment or materials substitutions. Proposed substitutions requests shall provide proof of compliance with OWNER'S criteria described in this specification.

   3. Submittals must comply with contract general provisions.

1.06 QUALITY ASSURANCE

A. Work shall conform to CCR, Title 24 Part 3, Basic Electrical Regulation and National Electrical Code, latest edition.

B. Only a qualified CONTRACTOR holding licenses required by legally constituted authorities having jurisdiction over the work, shall do the work.

C. Persons skilled in trade represented by work, and in accordance with all applicable building codes, shall install system in accordance with best trade practice.

D. Work shall be performed by CONTRACTOR that has completed at least 5 college level systems of equal scope to system described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years. CONTRACTOR shall maintain a fully equipped service organization capable of furnishing repair service to equipment.

E. The CONTRACTOR shall use adequate numbers of skilled workmen who are currently manufacturer certified, thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work.

F. The CONTRACTOR shall coordinate cable runs, and rack equipment locations with the OWNER's Authorized Representative during the initial design of the cable installation. CONTRACTOR and OAR must agree as to the final location of all devices and the cable plant design.

G. The CONTRACTOR shall provide technicians and tools required to participate in OWNER's Quality Assurance Testing as detailed in Attachment "A" of this specification.

1. Items on check list of Attachment "A" will be examined as a minimum at the Public Address Head End, terminal cabinets, ground vaults and classrooms. Should the examination show deficiencies related to items in the checklist, OWNER's acceptance testing will be discontinued until corrections have been made. When the CONTRACTOR has completed the corrections, a subsequent Quality Assurance test shall be initiated. This procedure is in addition to the system functionality testing required in section 3.03 below.

1.07 WARRANTY

A. CONTRACTOR shall warranty that all work executed and materials furnished shall be free from defects in materials and workmanship for a minimum period of five (5) years from date of installation acceptance, date of Contract Completion, excluding specific items of work that require a warranty of a greater period as set forth in this Specification. In the event a manufacturer's warranty is longer than five (5) years, the manufacturer's warranty shall be the warranty period. Immediately upon receipt of written notice from the OWNER, the CONTRACTOR shall repair or replace at no expense to the OWNER, any defective material or work that may be discovered before final acceptance of work or within warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the OWNER shall not relieve CONTRACTOR from these obligations.

B. All warranty shall provide the District direct access to manufacturer Technical Assistance Center (TAC), software updates, and defect support.

C. Equipment or materials failure rates of 10% or more during the warranty period:

1. The District shall monitor the performance and reliability of the installed base of Equipment and Materials installed in this Contract. Any deficiencies or malfunctions will be referred to the CONTRACTOR for repairs or equipment replacement.

D. If the District detects a defect within a warranty period as defined here in, it shall notify the CONTRACTOR Representative in writing ("Notice of Defect"). The CONTRACTOR shall make available and provide the District with the telephone number of a fax machine to receive Notices of Defect. This fax machine shall be available to receive faxes 24 hours per day 7 days per week, including all weekends and holidays

E. Upon receipt of written notice from the District of any failure or defect ("Defect") in any such Equipment or Work, the CONTRACTOR shall diligently perform all work necessary to determine the cause thereof, and the time necessary to remedy the Defect, and shall propose in writing to the District how and in what manner it will remedy the Defect. If the District determines that the proposal complies with the terms of the Contract, it shall authorize CONTRACTOR to proceed to redesign, repair, or replace the defective or failed Equipment or Work within the agreed time period.

F. In determining the cause of the Defect, the CONTRACTOR shall perform such investigations and tests as may be required to determine the cause, and to verify that such redesign, repairs, and replacements comply with the requirements of the Contract Document. All cost associated with such investigation, redesign, repair, replacement, and testing, including, but not limited to, the removal, replacement, and reinstallation of equipment and materials necessary to gain access to defective Equipment, shall be borne by the CONTRACTOR. Should the CONTRACTOR fail to

promptly make the necessary investigations, redesign, repair, replacement, and test, the District may perform or cause to be performed the same at the CONTRACTOR's expense.

G. The CONTRACTOR will warrant the redesigned, repaired, or replaced Equipment against defective design, materials, and workmanship for the remainder of the warranty period or a period of to five (5) years from and after the date of acceptance of the redesigned, repaired or replaced Equipment thereof, whichever occurs later.

H. The CONTRACTOR shall be liable for the satisfaction and full performance of the warranties as set forth herein.

I. All warranties hereunder are deemed and acknowledged to explicitly extend to the future performance of the Equipment warranted.

J. The rights and remedies provided for herein are cumulative and shall not be exclusive and are in addition to any other rights and remedies provided by law, whether in contract or tort, or under this Contract.

K. CONTRACTOR is deemed and acknowledged to be a merchant with respect to all components and replacement parts furnished pursuant hereto, and the District is acknowledged not to be a merchant with respect thereto.

L. In the event any Supplier or manufacturer offers any extended warranty not specified herein, CONTRACTOR shall state the terms of such warranty or warranties in writing and shall extend the same to the District without additional cost to the District.

M. All warranties and guarantees of Suppliers of any tier and Manufacturers, whether expressed or implied, are deemed to be made for the benefit of the District regardless of whether stated as such, and CONTRACTOR shall enforce such warranties and guarantees for the benefit of the District.

N. CONTRACTOR shall include a letter signed by a corporate officer, partner, or OWNER of the contracting company describing their service organization, its capabilities and commitment to servicing the warranty on all work executed and materials furnished.

1.08 SYSTEM REQUIREMENTS

A. The system shall be a combined public address and intercommunication system. Furnish, install, configure and connect all necessary sub-components to provide for functions and requirements specified, including interfaces and cabling to VoIP Telephone system, autonomous systems' overrides, the Master Clock system and the Fire Alarm system.

1. Provide all labor, engineering, testing, materials, supervision, tools, mounting hardware, cable management, software and components necessary or required to provide a complete operable installation. The system shall be installed in compliance with project documents, applicable codes, and industry standards to deliver a system that meets standards of quality functionality.

2. Provide services on Project site including specified connectivity for all administration areas, classrooms, computer and science laboratories, libraries, auditoriums, multipurpose rooms, P.E. areas, quad area other instructional areas, and work areas as indicated in Project Drawings.

3. The CONTRACTOR shall provide full configuration services for all CONTRACTOR provided equipment.

B. Basic Requirements:

1. System shall be packet audio technology IP network based.
2. System shall leverage existing structured cable plant, which is typically consisting of multi/single mode fiber optic backbone and horizontal Cat6.
3. System shall have sufficient capacity for expansion without the need of adding equipment to the head end equipment.
4. System endpoint devices shall be in compliant to applicable standard TCP/IP e.g. IP Multicast, DHCP, DNS, NTP.
5. System endpoint devices shall support IEEE 802.3af or 802.3at.
6. System shall support IETF SIP.
7. System shall be capable of connecting exchanges, IP network audio adapters, IP amplifiers, IP speakers, IP paging stations and various gateway types interfacing to the IP networking infrastructure e.g. LAN, WAN.
8. System shall provide interfaces for full integration with VoIP Telephone systems for emergency 911. The classroom phones shall be provisioned for direct dialing to a 911 operator.
9. System shall be provisioned for direct outbound dialing.
10. System shall be provisioned for inward dialing using the main school number and an extension number.
11. System shall provide local and/or remote authentication e.g. 802.1X, LDAP for system central management, administration, performance tuning, maintenance, and troubleshooting over the IP network.
12. System shall be capable of providing as a minimum three levels of accessibility rights. The levels correspond to multiple user access rights and individuals or group roles and responsibilities as follows:
    a. Level 1: System Engineer – A person at the enterprise level who possesses an in-depth system knowledge and is responsible for the overall system installation, configuration, performance tuning, and modification.
    b. Level 2: System Technician – A person who possesses relevant skillset, techniques, with a relative practical understanding the system to provide field troubleshooting/resolution in order to support end users.
    c. Level 3: End User – A person who uses the system on the regular basis.
13. System shall provide set up tool that will view all IP endpoints inventory and provide complete individual, group, or all device programming of those endpoints.
14. System shall provide secured access interface for daily functions such as audio files, events, bell schedules, emergency broadcast, emergency bell schedules, graphical interface, and text to speech.
15. System shall provide the ability to replace an IP device without the system having to be disabled during set up of new device.

16. Service shall not be interrupted while replacing an IP endpoint device and setting up the new device.

17. System control shall allow:

    a. Minimum of 100 independent operating groups/zones.

    b. Speaker volume shall be software adjustable to individual zones, multiple zones, individual or group of speakers.

    c. Configuration of individual device or group(s) of devices e.g. zone-specific requirements, endpoint device firmware upgrade.

    d. Alarm notification to administrators/support staff via SMS text or email of non-functioning components that need to be serviced.

18. System shall allow duplex conversation between stations, selective or master call to page all stations, background music or audio playback for common audio digital formats e.g. MP3, WAV, and WMA.

19. System shall provide capability and option to integrate with mass notification systems. System IP endpoints shall be Mass Notification ready and be accessed via the District Office in an emergency.

20. System shall employ echo cancellation that prevents acoustic feedback and echo for duplex hand-free conversations between stations.

21. All call paging access to individual speaker, zone paging, all calls, other rooms, etc. System also provides master clock or interface with the existing master clock system for a class change signaling system, and Fire Alarm system override of PA tone signaling capability and inhibition of all audio outputs including speakers and gateways during a fire alarm event.

    a. The system shall be equipped with a separate circuit to inhibit all loudspeakers audio outputs when a separate relay contact closure occurs from the Fire Alarm system. The closure shall also require activation of the muting relay circuits to all autonomous PA systems.

22. System shall provide the following Functions and Features:

    a. Scheduling – class change, bus loading, calendar based, standard or non-standard year-round.

    b. Emergency and overhead paging – send messages to any endpoint e.g. speakers, overrides all communication systems in event of sending/receiving critical messages.

    c. The system shall automatically reset all clocks at the pre-programmed times and dates of the start and end of daylight-saving time.

    d. The system shall be capable of interfacing with access control systems to initiate immediate lockdown control of all doors.

C. Intercommunication System:

1. Communication hardware shall be furnished with the capacity for internal communication between operator and selected classrooms. Calls from classroom telephones shall be enunciated by an alerting tone and shall appear on liquid crystal display (LCD) on an administrative telephone in Main Office.

2. The main operator shall be able to answer calls in sequence by depressing one button on administrative phone, or out of sequence by dialing the number of the desired classroom.

3. Calls to classrooms shall be announced by either a tone signal over the classroom speaker or by ringing the staff telephone.

4. Predetermination as to whether to ring the telephone or to permit talking over the speaker shall be user selectable when dialing.

5. Direct Dial Telephones: A direct-dial telephone system with electronic switching shall be furnished to accomplish the above description. The central switching private exchange or VoIP communication manager shall utilize standard touch tone signaling in compliance with standard telephone practices and operation.

6. Administrative Telephones: Administrative telephone communication system shall provide the following minimum requirements:

   a. Shall be a standard touch tone dialing telephone equivalent to those employed by public telephone carrier companies.
   b. Capability as provided for direct dialing, private, two-way telephone communication between all locations furnished with administrative telephone and staff telephone shall be provided.
   c. Capability as provided for any administrative telephone to transfer a call from another administrative telephone or any staff or classroom telephones to any other telephone.
   d. Capabilities, as provided for the instantaneous distribution of emergency announcements simultaneously to all locations furnished with loudspeakers.
   e. Provisions for restricting access to the emergency announcements to certain administrative telephone. This shall be accomplished by the use of an authorized administrative system programming or secured access interface.
   f. Capabilities as provided for the origination of normal and priority emergency calls from any staff station. Priority emergency calls shall take precedence over normal calls.
   g. Capabilities as provided for directory lookup and dial by name.
   h. Provisions for instantaneous distribution of announcements to prescheduled groups of speakers from an administrative telephone.
   i. Local diagnostic functions shall be provided to simplify maintenance.
   j. Programming: Authorized administrative system interface or telephone shall be able to distribute announcements to each individual speaker, intercom, zone page a group of speakers, or distribute all-call.
   k. Volume level shall be software adjustable to individual zone, multiple zones, individual speaker or group of speakers.
   l. Audio level of the telephone intercommunication system shall be adjustable at sound levels sufficient to override typical ambient school noise.
   m. Upon notification from the CONTRACTOR, the OAR shall contact the Network Operations and Telecommunications Branches of OWNER to arrange for ordering of necessary additions to the voice system to complete the installation of the PA-Intercom system. Any work to the VoIP system will be provided by the OWNER to encompass both hardware/software additions and any necessary programming and is outside of the scope of this specification. The Network Operations Branch or Telecommunications Branch will manage all connections to the VoIP Telephone system. Any vendor working on the

telecommunications system must be pre-approved by the Network Operations Branch or Telecommunications Branch prior to any work commencing.

D. Public Address: The system shall provide the following:

1. Reproduction of speech shall be clear, high fidelity and with all frequencies within range of system faithfully reproduced with no detectable noise, humming or distortion.

2. Reproduction of speech shall be attained at sound levels sufficient to override noise levels typical for schools.

E. Mass Notification Capabilities for Integration to:

1. Conduct Wide Area Mass Emergency Notification from a central control station to all schools, group of schools, a single school, multiple campus zones, in-building, group of classrooms, or individual classroom.

   a. Situation may include emergency, non-emergency, other events.

   b. Message types may include pre-written, Text-to-Speech, pre-recorded, and dynamic.

   c. Notification may be triggered from system authorized administrative application interface, manual desk phones, web access, cell phone, or email.

   d. Recipients may include students, school and central administrative staff, first responders, and parents.

2. Notification receiving devices may include but not limited to TV broadcast via District owned and operated KLCS Television station, landline/cellular phones, overhead speakers, SMS/Text messages, automated voice calls, email alerts, social media networking, or desktop.

3. Any reproduction of speech shall be attained at sound levels enough to override noise levels typical for schools.

1.09 SYSTEM DESCRIPTION

The Public Address/Intercommunications system shall be comprised of 2 integrated systems which shall provide means of performing public address functions and telephone.

A. Public Address and Intercom System.

1. Shall provide standard RCA jack for audio messages or music-on-hold (MoH) source input e.g. MP3, CD/DVD players.

2. Any handset on the PA-Intercom shall be able to initiate paging/intercom functions with a pre-program key or dialing a 5-digit key sequence.

3. The all page output with contact closure shall be connected to the telephone signal and telephone page control inputs on the intercom/program distribution control panel.

4. Automatic class change signaling system shall include manual controls to select program and to do all call. The number of class change signaling systems shall be determined by the number of learning communities or other academic entities at the site. The Public Address and Intercommunication system shall be able to support multiple class change signaling needs, by providing additional zones and tones. The class change tones shall be independently programmed to target each learning community on the campus. The

selected tone shall be distributed over the loud speaking intercom and P.A. system. In Middle and High schools, the class change signaling system shall be programmed to include dressing and cleanup tones for gymnasiums and shop zones.

B. The intercommunication system shall provide communication between classroom telephones, speakers, administrative phones and VoIP Telephone system and shall operate in conjunction with Public Address equipment. The system shall provide the following features and capabilities:

1. VoIP Telephone system shall be the main backend for all call processing.

2. Integration between the VoIP and PA shall allow paging to the overhead speakers from the VoIP phones.

3. Integration may include but not limited to:

   a. FXO, FXS, T-1 interfaces

   b. SIP over IP infrastructure

4. System shall be ADA compliant, the equivalent functionality of 2554 type wall mounted or 2500 type desk phones.

5. System shall provide intercom system dial tone for loop start trunk ports from the VoIP Telephone or IP Router.

6. System shall allow calls from the VoIP Telephone to individual intercom stations or to access page functions.

7. System shall be provisioned to allow minimum of eight simultaneous calls from the intercom system to outside lines. Intercoms: System shall provide VoIP phones with equivalent functionality of the 2554 or 2500 series in all rooms.

PART 2 - PRODUCTS

2.01 SYSTEM EQUIPMENT

The Public Address/Intercommunications Systems shall include the following equipment and components as identified on the project contract documents.

A. System Equipment Rack:

1. The PA-Intercom Head End Equipment shall be installed inside the Main server room MDF cabinet.

B. Uninterruptable Power Supply (UPS)

1. All PA-Intercom Head End Equipment and Head End network switches that support PA-Intercom connections shall be energized via a 90 minutes runtime battery backed UPS system.

2. All ESM network switches that support PA-Intercom field devices shall be energized via a 90 minutes runtime battery backed UPS system.

3. UPS systems shall support a native SNMP network management interface.

C. PA-Intercom Head End Processor

1. The PA-Intercom Head End Processor shall support the following services:

a. Contain the system software that controls system features, functions, scheduling of calendar-based events, daily announcements, tones, connections, zones, audio, data and

b. Provide all controls necessary for multi-participants conference calls, where applicable, and two-way intercom communication between any stations.

c. Shall provide automatic controls to adjust the emergency page volume, supervisory tone volume, time tone and to enable or disable the supervisory tone phantom power to microphone inputs.

d. Provisions shall include permitting emergency 911 dialing from classrooms and instructional support/administrative areas.

e. Provisions shall include service availability when WAN/MAN circuits are out of service via direct connection to PSTN e.g. local SIP trunk, PRI or POTS lines.

f. Provisions shall be included to permit emergency paging from a remote telephone, or microphone, which shall capture system priority and override all functions except for the emergency page feature.

g. Provisions shall provide all controls necessary for distribution of general announcements or program material to any or all classrooms, and transmission of emergency announcement to all classrooms.

h. Shall support secured web based configuration support for all PA-Intercom.

i. Shall support secured administrative login access.

j. Shall support Common Alerting Protocol (CAP) allowing interoperability with public alerting systems.

2. PA-Intercom Head End Processor hardware shall be provided with the following specification requirements:
   a. Equipped with SSD
   b. Minimum of one 10/100/1000 Mbps Ethernet interface; must be capable of supporting a second 10/100/1000 Mbps Ethernet interface.
   c. Shall be capable of supporting FXO/FXS interfaces and SIP allowing integration with PBX or VoIP systems.
3. Shall provide server disk image which include Operating System (OS), all applications and final site configuration for quick service restoration.
4. Shall provide management capabilities:
   a. Access locally or via programming software or secured web (SSL) interface
   b. Support local and centralized management for PA/IC system administration, regular maintenance, configuration, and system performance tuning and troubleshooting.
   c. Support 802.1X, Active Directory, and LDAP for secured access from anywhere on the District IP network.
   d. Support multiple user/group access privilege levels for their corresponding roles and responsibilities.
   e. Support SNMP for server status monitoring.

D. PA-Intercom VOIP Telephone Handsets:

1. VOIP telephone handsets shall be OWNER Furnished CONTRACTOR Installed.
2. The District shall provide The CONTRACTOR a Bill of Materials listing all proposed VOIP telephone handsets to be installed by the CONTRACTOR.

2.02 GROUNDING

Wiring enclosures, terminal cabinets, outlets, frames of cabinet racks and other enclosures shall be grounded in accordance with requirements of California Electrical Code and as specified, and as indicated in the ANSI/EIA/TIA applicable standard.

2.03 SPEAKERS AND ACCESSORIES

A. Loudspeakers shall meet or exceed the following performance specification:

1. At the minimum, equipped with one 10/100 auto negotiate Ethernet interface
2. Support 802.3af or 802.3at
3. Support DHCP and static IP addressing
4. Each loudspeaker mechanism shall be mounted in flush back-box or surface baffle as indicated on Drawings and as specified.

5. Adjust power delivered to each speaker, as necessary, to insure a satisfactory sound level, with reproduction of good quality, in each of locations where speakers are installed.

6. Loudspeaker Volume Controls: Loudspeaker volume controls shall be adjustable from the server via administrative programming or secured web interface (SSL).

7. Loudspeaker audio performance shall meet or exceed the following:

   a. Average Sensitivity: 95 dB SPL, 1W/1M

   b. Loudspeaker Power Rating: 12W RMS EIA 426A Standard

   c. Maximum Power Rating: 15W @ 8 Ohms

   d. Calculated Output: 102 dB SPL 5W/1M

   e. Frequency Response: 65 Hz - 17 kHz EIA 426A Standard

   f. Nominal Coverage Angle: 100° Included Angle -6 dB / 2 kHz, Half space

B. Horn Loudspeakers shall meet or exceed the following criteria:

1. Horn loudspeakers shall be provided in 15-Watt and 30-Watt options.

2. 15-Watt Horn Loudspeakers shall be furnished for outdoor areas such as lunch shelters, arcades, and walkways.

3. 30-Watt Horn Loudspeakers shall be furnished for large outdoor areas such as playgrounds, physical education fields, and athletic fields.

4. Horn Loudspeakers shall meet the following performance specifications:

   a. Network interface shall support at the minimum one 10/100 auto negotiate Ethernet interface

   b. Network interface shall support 802.3af or 802.3at

   c. Network interface shall support DHCP and static IP addressing

   d. Horn Loudspeakers shall be weatherproof vandal-resistant type.

   e. Horn Loudspeakers shall be installed with weatherproof cover plates with plastic bushed holes in plates to admit waterproof cable to speaker in drip loops.

   f. Each horn speaker assembly shall be mounted in a vandal-resistant steel enclosure.

5. Horn Loudspeaker audio performance shall meet or exceed the following:

   a. Average Sensitivity: 120dB at 15 Watts (peak) 114dB at 15 Watts / 1 Meter (avg) 700-5,500Hz

b. Minimum Loudspeaker Power Rating: 12W RMS EIA 426A Standard

c. Maximum Power Rating: 15W/30W @ 8 Ohms

d. Calculated Output: 102 dB SPL 5W/1M

e. Frequency Response: 600-14,000Hz (nominal) 700-5,500Hz (± 5dB)

f. Nominal Coverage Angle: 95° (-6dB, 2000Hz octave band)

2.04 NETWORK SWITCHING EQUIPMENT

A. Networking switching equipment shall be OWNER Furnished CONTRACTOR Installed.

B. The District shall provide The CONTRACTOR a Bill of Materials listing all proposed Network Switching Equipment to be installed by the CONTRACTOR.

2.05 IP TALKBACK AND ONE-WAY SPEAKER

A. At the minimum, talkback speaker shall support:

1. At the minimum, one 10/100 auto negotiate Ethernet interface
2. IEEE 802.3af or 802.3at
3. Network Time Protocol (NTP)
4. DHCP or statically IP addressable
5. Software volume control capability per speaker
6. Frequency response 80Hz to 15kHz
7. Input: 45Ω / 12Watts

B. One-way speakers

1. At the minimum, one 10/100 auto negotiate Ethernet interface
2. IEEE 802.3af or 802.3at
3. Network Time Protocol (NTP)
4. DHCP or statically IP addressable
5. Software volume control capability per speaker
6. Frequency response: 80Hz to 15kHz

2.06 NON-IP TALKBACK AND ONE-WAY SPEAKER

A. At the minimum, talkback speaker shall support:

1. Software volume control capability per speaker
2. Frequency response 80Hz to 15kHz
3. Input: 45Ω / 12Watts

B. One-way speakers

1. Software volume control capability per speaker
2. Frequency response: 80Hz to 15kHz

2.07 INTEGRATED IP CLOCK/SPEAKER

A. As provided, integrated clock/speaker shall support:

1. At the minimum, one 10/100 auto negotiate Ethernet interface
2. IEEE 802.3af or 802.3at
3. Network Time Protocol (NTP)
4. DHCP or statically IP addressable
5. Does not require a master clock
6. Time zones and automatic update system clock for annual Daylight Savings Time and Standard Time changes
7. Automatic time correction after complete power outage.

B. Power options

1. Primary source is PoE

2.08 CALL BUTTON

A. A call button unit shall be installed in each classroom at the location as indicated on the contract drawings or at a location as directed by the project ARCHITECT of Record.

B. The “Acknowledge Lockdown” action to be activated by engaging this call button to a registrar headend reporting location (e.g. classroom, confined office, etc.) is in the lockdown status.

C. The registrar lockdown status console must be accessible at any District designated location(s).

D. The “Call Office” button shall establish 2-way hand-free communication between classrooms over the talkback speaker and the main office designated device(s).

E. The call button shall meet the following requirements:

1. A single unit Two (2) button assembly (Red for “Acknowledge Lockdown” status report and Black or Navy Blue for classroom to “Call Office” the main office) capable of generating discrete critical and/or non-critical alerting to the Head End Processor.
2. Both “Acknowledge Lockdown” and “Office Call” buttons share the same wire pair.

2.09 GATEWAY/CONTACT CLOSURE

A. IP/Analog gateways

1. Interfacing field analog devices (e.g. speakers, handsets) to IP network.

B. Contact Closures

1. Interfacing the PA-Intercom with other systems (e.g. fire alarm, autonomous PA) for signal overriding.

2.010 CABLING SYSTEM

A. All system and sub-components shall be interconnected using the existing standard installed per EIA/TIA-568, 569, 606, 607 specifications data network cabling plant with no further modification. Solutions require non-standard custom cabling terminations are not acceptable.

B. Addition to the existing cabling plant shall be compliant with 27 0536 Cable Tray and 27 1014 Structured Cabling.

2.011 LABELING

A. Cable labeling shall be consistent with labeling requirements as defined in specification 27 1014 Part 3-Execution and Installation Subsection 3.04C.

2.012 KEYS AND LOCKS

A. Provide keys and locks for all cabinets and equipment; locks shall be keyed to a Corbin #90 key, for access to operate equipment and to service equipment.

2.013 PORTABLE EQUIPMENT

A. Furnish and deliver to the OAR, one auxiliary console microphone with coiled cord and press-to-talk switch.

B. Portable equipment shall remain in individual boxes and be delivered to the OAR.

PART 3 - EXECUTION AND INSTALLATION

3.01 INSTALLATION

A. Install equipment as specified, as indicated on Shop Drawings, and as required. Installation shall be in accordance with manufacturers' instructions and applicable codes. Installation shall be in accordance with manufacturers' instructions and applicable codes.

B. Systems that are re-designed with the intention to increase station or port capacity of systems shall not be accepted.

C. Systems not installed as manufacturer instructions shall not be accepted.

3.02 RELATED SYSTEM OR SUB-COMPONENT INSTALLATION

A. Public Address system installation

1. Rack Equipment Installation: All equipment within each rack shall be logically arranged for accessibility of convenient maintenance. Cables to shall be dressed only from the right side of the rack, as viewed from the rear. Cable bundle must be dressed neatly to allow room for system service.

B. Administrative display telephones

1. Unless otherwise shown on Contract Drawings, provide, program, install and connect a minimum of one administrative telephone in the Main Office, in each Academic Entity on the campus SLC and in each Academy.

C. Intercom instruments

1. Wall-mounted: Install where indicated modular wall plate.

2. Desk mounted: Install and connect where indicated and specified.

D. Special programming requirement

1. Privacy

a. The system shall be configured to prohibit the initiation of a two way conversation from any telephone or speaker to any speaker connected to the system without the presence of a supervisory or permitted privacy. This requirement extends to calls from the office to any classroom, from a classroom to any other classroom and from any classroom to any office.

b. The tone shall have sufficient volume to alert the occupant of a classroom with typical ambient sound that a two-way communications path has been initiated.

3.03 CERTIFICATIONS AND TESTING

A. Provide all instruments for testing and demonstrate, in presence of the OWNER, that all circuits and wiring test free of shorts and grounds.

B. Provide test and reception gear to test for specified performance of active equipment.

C. Furnish all labor, instruments, appliances, equipment, and materials necessary to demonstrate to the OWNER the installation performs as required and specified.

D. Before Substantial Completion, submit test results and related documents to the IOR.

E. The OWNER reserves the right to perform independent tests of equipment furnished, to determine whether or not equipment complies with requirements specified, and to proceed in accordance with the Contract Documents.

3.04 PROJECT RECORD DOCUMENTS

A. As-Built Documentation

1. Provide 3 Blue line copies size E (30” X 42”) of Project site and building plans, indicating location of equipment, conduit, cable routing, ground vaults terminal cabinets, pull boxes and other installation information.

2. Provide 3 copies on USB flash drive of the system CPU programming and configuration.

3. Provide two copies of the record Drawings in AutoCAD or Microsoft Visio format prepared using the most recent version of Windows compatible AutoCAD on a USB flash drive for use on a Windows platform.

a. OWNER utilizes layers as a key tool in controlling visibility of drawing elements and to provide consistent information between drawings yet provide control over what is seen on each sheet. Public Address wiring shall be shown on a separate layer, labeled as “Public Address” that uses both building floor plans and conduit supporting structure layers below. The use of any version control that blocks or company logo(s) shall be on a layer separate from the premise wiring as-built drawings.

b. All software copies supplied shall be multi-layer drawings, consistent with District AutoCAD standards. The following separate layers are expected in all drawings:

(1) Title blocks.

(2) Buildings

(3) Site plan.

(4) Separate layers for equipment, devices, cabling and other system components.

4. Floor plans indicating all devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of all cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable.

a. Drawings shall include block diagrams indicating all items and their point-to-point connections in a manner following floor and site plan layout. Drawings shall also include as-built single line diagram, cable site plot plan and floor plans indicating all cables, both underground and in each building with conduit, and as-built coding used on each cable.

b. Floor plans shall indicate all devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of all cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable

B. Operating and Servicing Manuals, Record Drawings:

1. Deliver three copies of operating and servicing manual. Each complete manual shall be bound in three ring binders and all data shall be typewritten or drafted.

a. Each manual shall include a page with Project site and Project name, date of Substantial Completion, CONTRACTOR name, address, telephone, and fax numbers.

b. Each manual shall contain a letter, signed by an officer of the company indicating the beginning and ending date of any warranties described in subsection 1.07 of this specification and shall describe the companies' commitment to service the warranty during the terms specified.

c. Each manual shall include all instructions necessary for proper operation and servicing of system and shall include:

(1) A single line diagram of the system indicating all items and their point-to-point connections in a manner following floor and site plan layout.

(2) A complete 2 wire diagram of all connections made between components inside the system console.

(3) A wiring destination schedule for each circuit leaving console and each rack.

(4) All custom fabricated circuits, components and connections not detailed in the manufacturer's manuals shall have wiring diagrams detailing to component level, and the way circuits are connected. Provide details of input/output voltages and input/output signal levels.

(5) A schematic diagram of each amplifier and other components, transistor complements and replacement part numbers.

d. Each manual shall also include as-built single line diagram, cable site plot plan and floor plans indicating all cables, both underground and in each building with conduit, and as-built coding used on each cable. Drawings Size A (8-1/2 inches x 11 inches) and size B (11 inches x 17 inches) shall be bound into the manual. Larger drawings shall be folded and inserted into transparent envelopes bound

into the manual. Programming forms of each system shall be submitted with complete information.

3.05 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.06 TRAINING

A. Before Substantial Completion, provide an eight-hour training instruction period to designated OWNER personnel. Contact OAR first, if assistance is needed in scheduling an appropriate time, location, or list of attendees for this training.

B. Instruction shall be based on manufacturers written operating instructions covering those features of interest to the OWNER and applicable to the Work. Instruction shall include the following:

1. Making normal calls from intercom telephone to other intercom telephones or to the intercom administrative station. Revisit office staff preferred method for clarity and understanding of function and methodology.

2. Answering normal calls from intercom telephones.

3. Transferring loudspeaker intercom calls from the speaker to the intercom phone.

4. Answering normal or emergency calls from the intercom administrative station.

5. Returning calls shown in the administrative station display queue.

6. Answering calls shown on the wall display from VoIP Telephone phones (remote answer feature).

7. Answering calls ringing at a secondary station from admin phone or assigned intercom phone.

8. Placing calls from VoIP Telephone to other phones.

9. Placing calls from intercom stations to VoIP Telephone phones.

10. Placing calls from intercom telephone to the public switched telephone network (PSTN).

11. Making an emergency all call from the rack, program all call, zone all call and individual announcement from the admin telephone and VoIP Telephone, and all-call from the hand held microphone located in the main office. Explain that emergency all-call from rack activates the hearing assistance system. Also explain where these hear assistance systems and the autonomous systems are located.

12. Show distribution of radio and media player programs.

13. Provide copies of manufacturer user's manual to training staff and explain all users' manual functions described. Provide 3 quick user's functions reference guides in a plastic laminated form. The training shall include hands on equipment.

C. After Substantial Completion and before contract completion, provide two additional one hour "refresher" instruction sessions at times agreed upon by the OWNER.

END OF SECTION

SECTION 27 51 26 - ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit block wiring diagrams and catalog data showing component interconnection and descriptive literature for all component parts and cabinets.

1.3 EQUIPMENT QUALIFICATION

A. All Equipment shall conform to Federal, State and Local applicable Codes, Ordinances and AHJ, and shall be listed and labeled by Underwriters Laboratories.

B. Assistive-Listening Systems

1. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.
2. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of the receivers provided, but no less than two shall be hearing- aid compatible in accordance with CBC Section 11B-706.3.
3. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50- foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B- 219.4.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Assistive Listening System shall include the following items

1. Instructor (program source) wireless transmitter units.
2. Student (audience) portable wireless receiver units.
3. Plug-in microphones and earphones, for each unit.
4. Multiple program source inputs for, Instructor’s microphone, respective room audio/video A/V system input/output and Instructor’s computer audio input/ output.
5. System accessories.

B. Function

1. The Assistive Listening System shall provide amplified available audio programs for hearing impaired students/audience, originating from classroom/stage/room instructors

and audio/video instructional program source materials, and equipment in respective building spaces, rooms, classrooms and outdoor areas.

2. The audible program shall be transmitted wireless from the program source to the student/audience, with reception coverage throughout not less than approximately 80% of the respective floor space/area space.
3. Shall provide automatic stereo or mono audio full system operation, depending on program source input.
4. The system in each space shall comply with Federal ADA, State and Local AHJ Requirements for the hearing impaired.

2.2 MATERIALS (RF WIRELESS)

A. General

1. Power for each portable unit operation shall be supplied by internal, changeable rechargeable NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer/two unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 10-hours with NiCad (NiMH) batteries. The batteries shall be rechargeable without removal from unit.
2. Provide power on-off control on each unit, to extend battery duration.
3. A protection circuit shall prevent battery “back-drain” if the power to the charger is turned off while the unit is being recharged.
4. The receivers and transmitters shall be US Government FCC and Industry Canada-approved, for FM- RF (radio frequency) wireless operation.
5. All components shall be the product of the same Manufacturer.
6. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Instructors Portable (Program Source) RF Transmitter Units

1. The transmitter, shall be compact, easily portable units, self-contained ABS, plastic housing/enclosure shall clip to a pocket or belt.
2. Each portable transmitter shall provide RF transmitting on one of the US Government 40 different FCC
3. – and Industry Canada-approved narrow-band channels in the 72-86MHz RF band.
4.
5. Line-of-sight transmit-distance range of not less than 100-feet up to 150-feet from transmitter to receiver.
6.
7. Easy-to-read channel label and volume adjustment on the front unit face. Stereo and mono audio processing.
8. 3.5mm auxiliary input jack that allows transmission of audio from an auxiliary source such as a cassette recorder, computer, CD/DVD player or television audio source. The transmitter shall also provide a second 3.5mm microphone input source jack. The two input sources shall be simultaneously operational to provide a mixed signal output RF transmission of the two sources.
9. Select the separate independent RF transmission frequency for each transmitter to prevent transmission interference between units and to provide for at least two student receiver units to selectively overlap reception of the transmitter.
10. Quantity of Instructor’s portable RF transmitters

a. Provide quantity of nine instructor portable transmitters, 3-on low band; 3-on mid band and 3-on high band RF frequencies.
b. Provide a quantity of one portable transmitter at the respective room audio/video (A/V) equipment, program output source. Provide 120 volt AC-to-DC power-supply for portable transmitter at the A/V equipment location.

11. Extended range fixed base non-portable RF transmitter.

a. Provide fixed location non-portable base unit RF transmitter for spaces larger than 9,000 square foot indoor or outdoor spaces.
b. Shall have the same RF characteristics and performance as the portable transmitter except as follows:

1) Line-of-sight transmit-distance range of not less than 800-feet from transmitter to receiver.
2) Fixed install location non-portable, with NEMA-1 metal housing.
3) Radiated RF energy intensity shall provide manual attenuation adjustments to prevent multiple adjacency RF interferences.

c. Provide a student/audience portable RF receiver unit at the RF base unit to receive RF signals from an instructors RF transmitter. Connect to the base unit to rebroadcast. Provide a self- contained 120-volt AC-to-DC power-supply for the portable receiver at the base unit transmitter.
d. Shall operate on 120 volt 60Hz AC branch circuit. Provide remote system master on-off control.
e. Provide remote RF antenna (outdoor/indoor) rated, for fixed base RF transmitter. Antenna shall extend the transmitter range for large spaces. Provide two RG-6 coaxial cable connects from antenna to base transmitter.

C. Student/Audience Receiver Units

1. The multi-channel narrow-band FM receivers shall be compact easily portable units, self-contained ABS/plastic housing/enclosure and shall clip to a pocket or belt.
2. The receiver shall provide an on/off switch and volume control which adjusts the output level as required by the listener.
3. The receiver shall have a 3.5mm output jack which accepts one of any of the plug-in listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.
4. The receiver shall have an easy-to-read channel label on the front face. The receiver shall incorporate an automatic squelch circuit which eliminates white noise when the receiver is out of transmission range. Stereo and mono audio reception and processing.
5. The multi-channel receiver shall receive any six of the US Government forty different FCC- approved narrow-band FM frequencies within the 72-76MHz band from the respective transmitter units. The user shall be able to change to any one of these six frequencies by using a slide or rotary switch on the receiver. Label on the front face shall indicate the receiver is a multi-channel unit. A label inside the battery compartment shall indicate the six channels that are available to the user.
6. Quantity of portable RF receivers

a. Provide a quantity of two receivers with matching frequencies for each transmitter, not less than eighteen total quantities of receivers.
b. Provide a quantity of one receiver with matching RF frequency of the transmitter at the respective room audio/video (A/V) equipment, program input source. Provide 120 volt AC-to-DC power- supply for portable receiver at the A/V equipment location.

c. Provide hearing aid compatible units at a ratio of one per four receivers in accordance with ADA 219.3.

D. RF System Accessories

1. Battery recharger portable charger/organizer pack.

   Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitter and receiver units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) transmitters receivers provided as part of the Contract.

2. Stereo audio headset style automatic noise canceling microphone, integral on-off-volume control and with behind the neck support style each with cable and outlet plug-jacks to match transmitter jacks. Provide two cables for each transmitter.
3. Equipment wall mount support brackets.
4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
5. Stereo audio headset style ear phones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each transmitter and receiver unit.
7. Locking auxiliary equipment storage cases for cables, microphones and headsets, with quantity and capacity for all auxiliary accessories furnished as part of the Contract.

2.3 MATERIAL (INFRARED WIRELESS)

A. General

1. All equipment shall be the product of the same Manufacturer.
2. The receivers and transmitters shall be US Government FCC and Industry Canada-approved.
3. Provide power on-off control on each unit, to extend battery duration.
4. As manufactured by Williams Sound; or PhonicEar; or Listen Technologies; or Centrum Sound.

B. Master (Program Source) Transmitter (Infrared Emitter) Units

1. The infrared emitter/transmitter shall be compact, portable units, self-contained ABS/plastic housing/ enclosure.
2. The emitter panel shall be a dual-channel system operating on both 2.3 and 2.8MHz invisible infrared light waves' frequencies. The channels shall be designated "CHANNEL A" for the left and "CHANNEL B" for the right.
3. The emitter shall provide left and right AUDIO IN jacks to accept an input signal from a sound system, left and right "SYNC IN/SYNC OUT" jacks for master/slave daisy-chaining with other emitters if desired, and left and right "MIC-IN" jacks to accept an audio signal from a microphone or Audio/ Video preamplifier.
4. The emitter shall provide separate LED input level detectors for each channel which illuminate when the audio signal peaks. Stereo and mono audio processing.
5. The emitter shall be mounted by the following methods:

   a. Fixed to a wall with an adjustable, wall-mounting support bracket accessory.
   b. Portable mounted to a table-top-or floor-stand, using accessory support-stand adapter.

6. Each emitter shall provide an array of not less than 130-infrared LEDs covered by an infrared transparent acrylic lens. The infrared signal from each emitter shall cover not less than 3,000 square feet (32,000 cubic feet) enclosed space. Note: For room sizes smaller than 3000 square feet, the infrared transmitter/emitter infrared output shall be reduced to accommodate the actual smaller room square feet size and height.
7. 120 volt 60Hz AC input to nominal 24-volt DC output (plug-in “power-brick”) power supply external transformer shall be UL approved, with cable “plug-in” connection to emitter/transmitter. Provide remote system master on-off control.
8. Slave emitter/transmitter for rooms exceeding 30,000 cubic feet. Provide one additional infrared emitter/transmitter repeater slave unit, for each additional 30,000 cubic feet room volume, or fraction thereof. The slave repeater shall receive and retransmit the program signals from the master unit. Provide one 100-foot long “master-to-slave” auxiliary portable extension wire cable for each slave unit.
9. Provide wall mount plug-in outlets for instructors’ microphone outlet connect ports to emitter/ transmitter.
    a. Provide 1.0-inch conduit and wire, homerun connect from microphone outlet to each room respective emitter/transmitter and slaves. Provide conductors as recommended by Manufacturer.
    b. Provide 1.0-inch conduit and wire homerun connect from microphone outlet to respective room Audio/Video (A/V) equipment, microphone program source input. Provide conductors as recommended by Manufacturer.
10. Provide a quantity of nine emitter/transmitter “master” units, plus additional “slave” units for adjusted room sizes.

C. Student/Audience Receiver Units

1. Battery Power
    a. Power for each unit operation shall be supplied by internal, changeable rechargeable NiCad batteries and alternately by alkaline disposable batteries. Rechargeable batteries shall be recharged without removal from the unit. Each unit shall have a charging indicator light. The batteries shall be recharged from either a portable charger/organizer and with wall transformer / two unit chargers. The units shall operate for up to 40-hours with alkaline batteries, and up to 15-hours with NiCad (NiMH) batteries.
    b. Provide power on-off control on each unit, to extend battery duration.
    c. A protection circuit shall prevent battery “back-drain” if the power to the charger is turned off while the unit is being recharged.
2. The receiver shall be a dual-channel unit for wearing around the neck with an adjustable strap. Stereo and mono audio reception and processing.
3. Compatible with the transmitter (emitter) and operate on 2.3MHz and 2.8MHz frequencies invisible infrared light waves. Self-contained and switchable from “CHANNEL A” to “CHANNEL B” through a switch located on the back of the unit.
4. The receiver shall provide an infrared light-gathering lens on the front of the unit to focus the light signal from the emitter onto the infrared detector element. The receiver shall detect and decode the infrared emitter/transmitter light source within a 160□ acceptance angle.
5. Audio squelch circuit which turns the output circuit off when the infrared signal is reduced or not received, with on/off and volume control.
6. Output jack, which accepts any of the listening accessories. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation.

7. Shall be compact easily portable units, self-contained ABS/plastic housing/ enclosure with red infrared receiver lens. Shall clip to pocket or belt.
8. Provide quantity of two infrared receivers for each master transmitter, not less than eighteen total quantities of receivers.

D. Infrared System Accessories

1. Battery recharger portable charger/organizer pack.

   Locking, portable case with cover, shall accept a group of not less than twelve plug-in portable transmitters and receivers units in each pack for simultaneous multi-unit battery recharging. Provide a quantity of one organizer for each quantity group of twelve (or fraction thereof) receivers provided as part of the Contract.

2. Stereo audio headset style automatic noise canceling microphones, integral on-off-volume control and with behind the neck support style. Each with 25-feet long extension cables and outlet plug-jacks to match transmitter outlet jacks. Provide two cables for each emitter/transmitter.
3. Equipment wall mount support brackets.
4. Auxiliary audio program source 15-feet long cables with plug-in at both ends to match transmitter jacks. Provide two for each transmitter.
5. Headset style ear phones with cable and plug to match receiver jacks. Headsets shall provide magnetic induction pick-up for hearing impaired, hearing aid interface operation. Provide one headset for each receiver.
6. Rechargeable Ni-Cad (NiMH) batteries, one complete set for each unit.
7. Locking auxiliary equipment storage cases for cables, microphones and headsets. Quantity and capacity as required to store all accessories.
8. Portable floor stand, for infrared emitter/transmitter units mounting and support, with variable height adjustment and tip-resistant weighted base. Provide one floor stand for each infrared emitter/ transmitter.
9. Locking, portable case for infrared emitter/transmitter. One for each emitter/ transmitter unit.
10. Provide microphone extension cable with plug to match microphone and infrared emitter/transmitter microphone input jack, 25-feet length. One for each microphone.

PART 3 - EXECUTION

3.01 GENERAL

A. Each System General

1. Assemble, set up, and test each transmitter, receiver, and accessories units.
2. Install and fully charge all batteries prior to and after testing/set up is complete.

B. Wireless RF Units

1. Perform an onsite RF frequency survey to determine available unused RF channels, prior to selecting unit operating channels and prior to ordering the equipment.
2. Select operational RF frequency to prevent system RF interference’s with other equipment.
3. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6 female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to- portable cable plug-in transition and circuit

impedance matching audio/transformer, into respective equipment. Additionally provide four Portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.

C. Wireless Infrared Units

1. Provide aiming and intensity adjustments of emitter/transmitter units to insure complete room coverage.
2. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA-568C 4-pair, UTP cables connecting from each emitter/transmitter master outlet box location to respective room instructors microphone outlet box location. Provide matching RJ-45 Category-6 female jacks at each outlet box for each cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45-to- portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally provide four portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.
3. Provide - one 0.75-inch conduit with two Category–6, ANSI/EIA/TIA – 568C, 4-pair UTP cables connecting from each emitter/transmitter master outlet box location to respective room audio amplifier
4. / preamplifier location. Provide matching RJ-45 Category-6 female jacks at each outlet box location for each UTP cable. Provide an audio circuit matching Balun at each outlet RJ-45 jack location, for RJ-45- to-portable cable plug-in transition and circuit impedance matching audio/transformer, into respective equipment. Additionally provide four portable Category-6 patch cables with RJ-45 jacks on each end of 7-foot long patch cable. Typical for each outlet location.

END OF SECTION

SECTION 27 53 13 - CLOCK SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
2. General Provisions and Requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit block wiring diagram of the clock and paging systems, showing headend equipment, terminal cabinets, remote power supplies, and typical clock for each zone.

1.3 EQUIPMENT QUALIFICATION

A. The Specification is based on the equipment of Manufacturers who have been approved by the District and the Manufacturers herein named shall be considered as meeting the Requirements of this Specification. For all items which are identified by part number and Manufacturer the Performance Specifications which are published in the most recent Manufacturer's data sheets available at the time of bidding this Project shall be applicable to the present work as though fully written out herein.

B. All equipment shall conform to all local applicable Codes and Ordinances, and shall be listed by Underwriters Laboratories.

1.4 QUALIFICATIONS

To qualify as an acceptable Bidder, whether the bid is submitted to the District, his Agent, a General Contractor or a Sub-Contractor, the System Bidder or Contractor shall be qualified Sound Contractor and shall hold a valid C61 License issued by the Contractors State License Board of California. The System Bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted Authorities Having Jurisdiction (AHJ) over the work. The Contractor shall be the Factory Authorized Distributor for the brand of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least 5-years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.

1.5 GENERAL REQUIREMENTS AND SCOPE

A. Furnish and Install a complete new GPS wireless clock system using Primex Wireless Inc. GPS wireless system or equal by American Time and Signal, Sapling. All bids shall be based on the equipment as specified herein.

B. Section includes Transmission Systems GPS Receiver, Primary Transmitter, and Satellite Transmitter.

1. Clocks:

a. Analog
b. Digital

1.6 RELATED SECTIONS

Division 26 – Electrical (120 volt grounded outlet required for transmitter).

1.7 REFERENCES

This Technical Specification and Associated Drawings, Primex Wireless GPS Satellite Time System User Manual.

1.8 DEFINITIONS

GPS: Global Positioning System, a worldwide system that employs 24-satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits Universal Coordinated Time, the world's most accurate and reliable time.

1.9 SYSTEM DESCRIPTION

A. GPS wireless clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

B. The system shall provide wireless time using GPS and be synchronized to UTC. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Saving Time

C. Analog Clocks shall be synchronized to within 10-milliseconds 6-times per day, and the system shall have an internal oscillator that maintains plus or minus 1-second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

D. The system shall include an internal clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating time.

E. The system shall incorporate a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

F. Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

G. The system must operate in accordance with a "Radio Station Authorization", Form FCC 601 – LM, granted by the Federal Communications Commission (FCC). This license will be issued to and held by the end user.

1.10 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of Manufacturer's latest model.

B. The end user will hold a License, known as a "Radio Station Authorization" granted by the FCC.

C. This License grants the end user protected use for wireless transmission at the designated frequency.

D. This License will designate a unique "call sign" for each end user.

E. Transmitter and Receiver shall comply with Part 90 of FCC rules as follows:

F. This device may not cause harmful interference, and

G. This device must accept interference received, including interference that may cause undesired operation.

H. Transmitter frequency shall be Governed by FCC Part 90.35.

I. Transmitter output power shall be Governed by FCC Part 90 257 (b)

J. System shall be installed in compliance with Local and State Authorities Having Jurisdiction.

K. Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment. Furnish the license or a copy of the application for the license, to the District/End User prior to operating the equipment. The original license must be delivered to the District/End User.

L. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed.

M. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

N. Floor Plans indicating the location of system transmitter(s), approved by Manufacturer, will be submitted to District prior to installation.

1.11 QUALITY ASSURANCE

A. Permits: Obtain Operating License for the transmitter from the FCC.

1. Qualifications:

a. Manufacturer: Company specializing in manufacturing commercial time system products with a minimum of 30 continuous years of documented experience including 4 years' experience producing GPS wireless time systems.
b. Installer: Company with documented experience in the installation of commercial time systems.

2. Prior to installation, a site survey must be performed to determine proper transmitter placement.

1.12 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the Manufacturer's original packaging. Packaging shall contain Manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.13 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Coordinate installation of GPS receiver for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

1.14 SYSTEM STARTUP

At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all clocks are functioning.

1.15 WARRANTY

Manufacturer will provide a 1-year warranty on GPS receiver, transmitter, and satellite transmitter. All other components will have a 1-year warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURER

GPS wireless clock system shall be manufactured by Primex Wireless, Inc., N3211 County Road H, Lake Geneva WI 53147, telephone (800) 537-0464, Fax (262) 248-0061, www.primexwireless.com or equal by American Time and Signal, Sapling.

2.2 SEQUENCE OF OPERATION

A. Transmitter Operation: When power is first applied to the transmitter, it checks for and displays the software version. It then checks the position of the switches and stores their position in memory. The transmitter looks for the GPS time signal. Once the transmitter has received the GPS time, it sets its internal clock to that time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock every time it receives valid time data from the GPS.

B. Analog Clock Operation:

1. Apply power or insert batteries. Follow set up procedures detailed in Manufacturer's instructions.
2. After initial setup, the clock will shut off the receiver. Six times each day, the microprocessor will activate the receiver and starting with the stored channel, it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.
3. If the clock has not decoded a valid time signal for a pre-determined number of days, it will go to a step mode. Non signal reception can be caused by low battery voltage. If this occurs, replace the batteries.

2.3 EQUIPMENT

A. General: The clock system shall include a transmitter, a roof or window mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. The GPS Receiver shall be a complete GPS receiver including antenna in a waterproof case, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure.

C. The GPS Receiver cable must be plenum rated where required by local Code.

D. Transmitter: Primex Wireless Model 14400, consisting of wireless transmitter with GPS receiver, a surge protection device/battery backup, and a mounting shelf. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.

1. Transmission:

a. Frequency Range: 72.100 to 72.400 MHz.
b. Transmission Power: 1 watt (30dBm) maximum
c. Radio technology: narrow band FM
d. Number of channels: 16
e. Channel bandwidth: 20kHz maximum
f. Transition mode: one-way communication
g. Data rate: 2 KBps
h. Operating range: 32 degree F to 158 degrees F (0 degrees C. to 70 degrees C).

2. Transmitter:

a. Transmitter output power: +26 to +30 dBm

b. Frequency deviation: +/- 4 kHz
c. Transmitter Power Requirements: 120 VAC 60 Hz
d. Internal Power Requirements: 5 VDC
e. Carrier frequency stability: +/- 20 ppm

3. Transmitter shall have 16 selectable channels to assure interference-free reception.
4. Transmitter shall have the following switches:

   a. Time zone adjustment switches for all time zones in the World. Includes Eastern, Central, Mountain, Pacific, Alaska, and Hawaii.
   b. Daylight Saving Time bypass switch.
   c. 12-hours or 24-hours display.

5. Transmitter housing shall be black metal case, 16¾-inches (424.4mm) by 12 inches (304.8mm) by 1-7/8 inches (46.4mm) in size.
6. Antenna shall be 46-inches (1168mm) high, commercial type, mounted on top center of transmitter housing. Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.
7. Transmitter housing shall incorporate a display which shall include the following:

   a. Time readout
   b. AM and PM indicator if 12-hour time display is set
   c. Day and date readout
   d. Indicator for daylight savings or standard time
   e. LED which shall flash red in event of reception problem
   f. GPS reception indicator

8. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.
9. Power supply (included):

   a. Input: 120 volt AC 50/60 Hz, 0.4 amps.
   b. Output: 9 volt DC, 1.5 amps.

E. Surge Protector/Battery Backup (included).

1. Input: 120 volt AC 60 Hz +/- 1 Hz.
2. Output: 120 volt AC, 500VA, 300 watts
3. Surge Energy Rating: 365 joules

F. Additional Equipment

1. Wireless Receiver Switches: Switches shall receive time packets from the Primary Transmitter and relay the synchronized time to the Satellite Transmitter connected to it. The unit shall include the following:

   a. Antenna mounted on top of the switch housing, 11½-inches (292mm) long. Power Supply:
      1) Input 120 VAC 50/60Hz, 0.4 amps
      2) Output: 9 volt DC, 1.5 amps RS 232 data cable, 5 feet (1.5mm) long

   b. Daylight Savings Time bypass switch
   c. Dimensions: 4¼-inches (108mm) long, 5¾-inches (146mm) wide, 1¼-inches (31.75mm) deep.
   d. Weight: 12 ounces (.34kg)
   e. Operating Range: 32 degrees F to 158 degrees F (0 to 70 degrees C)

2. Satellite Transmitters Primex Wireless Model 14401: Satellite Transmitters shall receive the signal from the Wireless Receiver Switches and transmit the signal to the devices in its

vicinity, which are out of the range from the Master Transmitter. The unit shall include the following:

a. Antenna mounted on top of the housing, 46 inches (1168mm) long.
b. Wireless Receiver Switch.
c. Power Supply Input: 120
d. VAC, 50/60Hz, 0.4-amps
e. Output: 9 volt DC, 1.5-amps.
f. 6 foot (1.83m) cord
g. Surge Suppressor/Battery Backup
h. Mounting Shelf.
i. Transmission Power: 1 watt maximum
j. 72 MHz frequency.

3. Traditional analog clocks (battery): Analog clocks shall be wall mounted. Clocks shall have poly- carbonate frame and polycarbonate lens. Face shall be white. Hour and minute hands shall be black.

a. 9 inches (228.6mm) diameter analog clock: Primex Wireless Model 14280
b. 12½-inch (317.5mm) diameter analog clock: Primex Wireless Model 14155
c. 16 inches (406.4mm) diameter analog clock: Primex Wireless Model 14163
d. 24 inches (610mm) diameter analog clock: Primex Wireless Model 14346

4. Additional colors, finishes, and dial faces are available from Manufacturer.

a. Analog clocks shall be battery-operated,
b. Analog clocks shall be capable of automatically adjusting for Daylight Saving Time. An on-off switch located on the transmitter shall disable this function if desired.
c. Time shall be automatically updated from the transmitter 6 times per day.
d. Analog clocks shall remember the time during changing of batteries.
e. 9 inches (228.6mm) and 12.5 inches (317.5mm) analog clocks shall have a tamper proof/ theft resistant clock lock mounting slots.

5. Analog clock receivers shall be as follows:

a. Receiver sensitivity: >-110 dBm
b. Receiver power: 24 VAC or 120 VAC (see model #)
c. Antenna type: internal
d. Antenna gain: -7 dBd

If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded. If signal transmission is not restored after 96 hours, the second-hand will “five-step” as a visual indicator that the signal has been lost. Should the clocks lose power and signal, the clocks will not function.

6. Wire guards: Provide one for each analog clock as follows:

a. Analog clock wire guard Primex Wireless Model 14131, 14-inches by 14-inches (355.6 by 355.6 mm) size, for nominal 12½-inch (317.5 mm) diameter analog clocks.
b. Analog clock wire guard Primex Wireless Model 14123, 18-inches by 18-inches (457.2 by 457.2mm) size, for 16 inches (406.4mm) diameter analog clocks.

7. Cable Connection Sealant: Radio Shack Coaxial Cable Connector Sealant 278-1645, or approved electrical grade silicone sealant.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

B. Verify that 120-volt electrical outlet is located within 6 feet (1.83m) of location of transmitter and the outlet is operational and properly grounded.

3.2 INSTALLATION

A. Provide all equipment necessary for a complete and operable system.

B. Transmitter: Locate transmitter where indicated, a minimum of 2 to 3 feet (.6 to 1 meter) above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls. Transmitter(s) will be placed at locations indicated below:

1. Attach receiver to transmitter using cable.
2. Connect antenna to transmitter, using care not to strip threads.
3. Connect power supply to the transmitter. Set the channel number on the display to correspond to the FCC license.
4. Plug power supply into electrical outlet.

C. Analog clocks shall perform the following operations with each clock:

1. Set clock to correct time in accordance with Manufacturer's instructions.
2. Observe analog clock until valid signals are received and analog clock adjusts itself to correct time.
3. Install the analog clock on the wall in the indicated location, plumb, level and tight against the wall. If using 12½-inch (317.5mm) clock, attach using clock-lock hanging method and suitable fasteners as approved by Clock Manufacturer.
4. Wire guards: Secure to wall, using approved theft-resistant fasteners.

3.3 ADJUSTING

Prior to final acceptance, inspect each clock, adjust as required, and replace parts which are found defective.

3.4 CLEANING

Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by Clock Manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.5 DEMONSTRATION

Provide training to District's Representative on setting and adjusting clocks, replacing batteries and routine maintenance.

3.6 PROTECTION

Protect finished installation until final acceptance of the Project.

3.7 TESTING

All devices must be tested at their operational location under normal operational conditions to assure reception of signal.

END OF SECTION

DIVISION 28

ELECTRONIC SAFETY & SECURITY

SECTION 28 13 00 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes access control door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Section includes, but is not necessarily limited to, the following for the integrated access control security and site management system:

1. IP-enabled integrated access control door hardware.
2. Monitoring and signaling equipment.
3. System network control processors.
4. Reader controller interfaces and modules.
5. Input monitor and output control interfaces and modules.
6. Remote card readers and display terminals.
7. Power sourcing equipment, network switches and wireless access points.
8. Access control cards and credentials.
9. Access control system application software.
10. Access control system power supplies, back-ups and surge protection.

C. Related Sections:

1. Section 01 79 00 - Demonstration and Training: Operations and Maintenance.
2. Section 08 06 71 - Door Hardware Schedule.
3. Section 08 11 13 - Hollow Metal Doors and Frames.
4. Section 08 71 00 - Door Hardware.
5. Division 26 - Electrical: Connections to electrical power system and for low-voltage wiring work.
6. Division 27 - Communications: Connections to the LAN.
7. Section 284620 - Fire Alarm System: Connections to building fire alarm system.

1.2 REFERENCE STANDARDS

A. BHMA A156.13 - American National Standard for Mortise Locks and Latches Series 1000; 2012.

B. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

C. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

D. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

E. IEEE 802.3 - IEEE Standard for Ethernet; 2015, with Amendments, 2016.

F. NFPA 101 - Life Safety Code; 2015.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

H. TIA/EIA-568 - Commercial Building Telecommunications Cabling Standard; Rev C, 2012 and latest addenda.

I. Codes and References: Comply with the current version adopted by the Authority Having Jurisdiction.

1. See Section 014100 - Regulatory Requirements.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. System Operational Descriptions: Complete system operational narratives for the integrated access controlled openings defining the Owner's Prescribed Requirements for the opening functionality. Narratives include, but are not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.

C. Shop Drawings: Details of electrified integrated locking hardware and access control firmware, indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication and control of the access control system electrified hard- ware and firmware. Differentiate between Manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and inter- connection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of Manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized Provider of the primary access control components.

E. Keying Schedule: Reference Division 08 Section "Door Hardware".

F. Product Test Reports: Indicating compliance with Cycle Testing Requirements, based on evaluation of comprehensive tests performed by Manufacturer and witnessed by a qualified Independent Testing Agency.

G. Operating and Maintenance Manuals: Provide Manufacturers operating and maintenance manuals for each item comprising the complete access control and site management installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and telephone number of the Supplier/Integrator providing the installation and the nearest Service Representatives for each item of equipment included in the system. The final copies delivered after completion of the installation test to include "As Built" modifications made during installation, checkout, and acceptance.

1. Record Drawings: During system installation, the Contractor to maintain a separate hard copy set of Drawings, Elevation Diagrams and Wiring Diagrams of the access control system to be used for Record Drawings. This set to be kept up to date by the Contractor with all changes and additions to the access control system accurately recorded.

H. Warranties and Maintenance: Special Warranties and Maintenance Agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage Qualified Manufacturers with a minimum of 5-years of documented experience in providing access control and security systems equipment and software similar to that indicated for this Project and that have a proven record of successful in-service performance.

1. Software and access control systems components to have been previously and thoroughly tested together with proven installations similar in size and functionality to the Design Requirements indicated for this Project.

B. Integrator Qualifications: Systems Integrators, verifiably factory trained and certified by the Primary Product Manufacturers, with a minimum 3 years documented experience installing complete integrated access control systems similar in material, design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance. Qualifications include, but are not necessarily limited, to the following:

1. References: Provide a list of references for similar projects including contact name, phone number, name and type of Project.
2. Professional Staffing: Firms to have a dedicated access control systems integration department with full time, experienced professionals on staff experienced in providing on site consulting services for both electrified door hardware and integrated access control systems installations.
3. Factory Training: Installation and service technicians are to be competent factory trained and certified Personnel capable of maintaining the system.
4. Service Center: Firms to have a service center capable of providing training, in-stock parts, and emergency maintenance and repairs at the Project site with 24-hour/7-days a week maximum response time.

C. Supplier/Dealer Qualifications: Supplier/Dealers verifiably authorized and in good standing with the Primary Product Manufacturers, with a minimum 3 years' experience supplying integrated access control systems similar in material, design, and scope to that indicated for this Project and whose work has resulted in construction with a proven record of successful in-service performance.

D. Integrated Wiegand Output, Wireless, and IP-Enabled access control products are required to be supplied and installed only through designated ASSA ABLOY "Authorized Channel Partner" (ACP) and “Certified Integrator” (CI) accounts.

E. Source Limitations: Obtain the access control door hardware, system firmware and application software specified in this Section from a single source, qualified Supplier/Integrator unless otherwise indicated.

1. Electrified modifications or enhancements made to a Source Manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide integrated access control door hardware from the same Manufacturer as mechanical door hard- ware, unless otherwise indicated.

F. Regulatory Requirements: Comply with Section 014100 - Regulatory Requirements and Guidelines as directed in the Building Code including, but not limited to, the following:

1. Comply with California Electrical Code, including electrical components, devices and accessories listed and labeled as defined in Article 100 by a Testing Agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Where indicated to comply with Accessibility Requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," CBC Chapter 11B as follows:
    a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    b. Door Closers: Comply with the following maximum Opening-Force Requirements indicated:
        1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
        2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Comply with NFPA 101 for doors in a means of egress.
4. Comply with NFPA 80 for fire labeled opening assemblies.
5. The installed access control system shall conform to all Local Jurisdiction Requirements.

G. Keying Conference: Reference Section 087100 - Door Hardware.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with Requirements in Section 013000 - Administrative Requirements with attendance by Representatives of Supplier(s), Installer(s), Systems Integrator(s), and Contractor(s) to review proper methods and procedures for receiving, handling, and installing door and access control hardware to Manufacturer's recommendations and according to Specifications.
    1. Prior to installation of door hardware, arrange for Manufacturers' Representatives to hold a Project specific training meeting on the proper installation and adjustment of their respective products. Product training to be attended by the Installers of access control hardware for the aluminum, hollow metal and wood door sections. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
    2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
    3. Review sequence of operation narratives for each unique access controlled opening.
    4. Review and finalize construction schedule and verify availability of materials.
    5. Review the required Inspecting, Testing, Commissioning, and Demonstration Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

1. Access control firmware and software: Where approved and directed, inventory upon receipt and store electronic access control equipment in a secure, temperature and humidity controlled environment in original Manufacturer's sealed containers.

B. Tag each item or package separately with identification related to the final Access Control Door Schedule, and include basic installation instructions with each item or package.

C. Deliver permanent keys, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner established at the “Pre- Submittal Conference".

1.6 COORDINATION

A. Coordinate quantity and arrangement of assemblies with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, recessed lighting fixtures, and other items.

B. Integrated Access Control Door Hardware and Electrical Coordination: Coordinate the layout and installation of scheduled integrated access control door hardware, and related access control equipment, with required connections to source power junction boxes, power supplies, detection and monitoring hardware and fire alarm system.

1. Door Hardware Interface: The access control system to interface and be connected to electrified and integrated access control door hardware as described under Division 08 Sections "Door Hardware" or "Access Control Door Hardware". Coordinate the installation and configuration of electrified door hardware being monitored or controlled with the controls, software and access control hardware specified in this Section.

C. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing electrified door hardware and access control system components. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing access control system hardware to comply with Indicated Requirements.

D. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article will not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and are in addition to, and run concurrent with, other warranties made by Contractor under Requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by Manufacturer(s), agreeing to repair or replace components of the installed access control system hardware and software that fails in materials or workmanship, including all related parts and labor, within specified warranty period after final testing and acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

Two years for Integrated Access Control Door Hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of standard and access control door hardware.

B. Maintenance Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provides continuous 6-months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

C. Maintenance Support and Extended Service Agreement: Submit for Owner’s consideration an optional extended Service Agreement for the installed access control system, including support for software related issues. The extended Service Agreement is considered elective and is without Manufacturer's Requirement stipulating mandatory coverage for owner and/or vendor system support.

1. A published copy of this Agreement to be included with the submittal package
2. Support for the installed access control system components is provided through the Vendor under a 24 hour Technical Assistance Program.
3. Access control and management system components are to be available on a 1-day turn-around time frame from the Manufacturer.
4. Primary Systems Manufacturer to offer and provide remote modem or internet access for direct factory support to the Vendor. The factory level support to include diagnostics and troubleshooting support on systems related issues at no additional cost to the Owner.

D. Access Control Software Upgrades: Version upgrades and "fix" releases to the access control system software are available at no extra charge as long as the version of software provided in this Specification remains the current Manufacturer’s version or for up to 2-years after a new version release.

1. Major access control software revisions that provide new functionality to the product provided free of charge for up to 1-year from the date of substantial completion.
2. Access control system software is to be upgradeable as may be required or as necessary, to expand and manage the Owner’s site or sites. Upgrades are to be offered at a published flat fee for the primary system software, with single license modules included in the primary fee structure. System upgrades offered at a costing structure based upon the original number of licensed modules issued, or on those to be purchased at a future date, are not allowed.
3. As part of the submittal package, provide a list of available software upgrades and/or expansions modules. List to identify related costs for upgrades, or expansions to the original system, up to the next qualifying operational level.

1.9 SCOPE OF WORK

A. Access Control Site Management System: Furnish and install at the indicated locations the specified integrated access control door hardware and access control system firmware and software for a completely operational access control and security site management system. System includes, but is not necessarily limited, to the following:

1. Electrified integrated access control locks and exit hardware, network control processors, reader controller panels, I/O monitor/control interfaces, door position switches, remote card readers, keypads, and display terminals, access cards and credentials, system application software, special tools, operating manuals, and required cabling and

accessories as detailed below and listed in the Access Control Hardware Sets at the end of Part 3.

a. Provide the appropriate number of reader controller panels and I/O monitoring / control expansion interfaces as needed to handle the number of card readers, locking devices, door status devices, and identified alarm inputs specified in this section, and as shown on the Security Drawings.
b. Provide Manufacturer approved integrated access control locks, exit hardware, and remote mounted card readers, keypads, and display terminals that are functionally compatible with the specified access control equipment interfaces.

2. Access control system equipment to be installed in an enclosure box compatible with the specified components. This enclosure to include, but is not necessarily limited to, the network control processor, I/O monitor/control interface panels, power supplies, terminal strips, wire ducts, keyed lock cylinder, integrated outlet for A/C power, and standoffs.

   a. Enclosure box to be located in the designated IT/Telecom room(s) with connection to the owner designated local area network for communication back to the central server host.

3. Owner to provide the following:

   a. Computer hardware and peripherals to be from an approved, Major Line Computer Manufacturer. The following Manufacturers will be considered “pre-approved”, however, specific information detailing compliance with the Manufacturer’s Requirements must be included within the Project submittal package as specified.

      1) Compaq
      2) Dell
      3) Hewlett-Packard
      4) IBM

   b. Central Server Host Computer:

      1) System Server to include the following Minimal Requirements: Windows Server 2003 (Service Pack 1 or higher) or later Operating System, Intel Pentium IV 1 GHz (equivalent or greater), SQL Server 2005 Express Edition or SQL 2005, 1GB Ram or larger, 120GB hard disk space available or more as needed, CRT or LCD minimum 15-inch display Monitor, CD/RW Drive. Single serial port, or multiple USB ports, and one parallel port, keyboard and mouse.

   c. Client Workstations:

      1) Client Workstation to include the following minimal Requirements: Windows XP Professional (Service Pack 2 or higher) or Windows Vista Business, Intel Pentium III 500 MHz (equivalent or greater), SQL Server 2000 Client Access License, 1GB Ram or larger, 30GB hard disk space available or more as needed, CRT or LCD minimum 15-inch display Monitor, CD/RW Drive. Single serial port, or multiple USB ports, and one parallel port, keyboard and mouse.

   d. Owner will be responsible for ensuring that each computer hardware component includes the required interfaces, expansion boards, and peripherals that will be

necessary to allow the system to operate as described within this Specification and as indicated on the Drawings.

e. Power Sourcing, Network Switches and Wireless Access Points: Quantity as required to accommodate installed access control (and video surveillance) devices.

f. Network Control Processor Connections:

1) LAN/Ethernet communication ports (jacks) and network interface cards as needed, CAT5e (CAT6) cabling from network router/switch to network control processor, outlet and cover plates and/or patch cables required for network connection within each designated IT/Telecom room.

2) Required static IP addresses.

4. Power Supplies, including battery or uninterrupted backup powers supply (UPS) and separately fused surge protection, required for the electrified door hardware, access control equipment, and PoE switches or wireless routers driving the integrated card reader locking devices.

5. Installation, final configuration and commissioning of electrified door and access control system hard- ware, communication firmware, power supplies and related accessories.

6. System application software including installation, programming, and end user training of the access control system demonstrating operating, repair, and maintenance procedures. Include on-site central server training for designated Personnel (facilities maintenance, security, IT, administration) by a Factory Certified Representative.

a. Include Client Software Application (client workstation) training at each of the remote installed facilities for local Administrative Staff.

7. Provide Manufacturer required power controllers, interface boards, and programming that may be required for approved electric latch retraction exit devices supplied under Division 08 Section "Door Hardware."

8. Electrical Contractor, Division 26, to provide the following:

a. Source power wiring (120VAC) as required for the integrated locking and access control hard- ware, equipment, accessories and power supplies. This includes quad outlets as required on a dedicated circuit in the designated IT/Telecom room(s) and the related conduit, stub-in, junction boxes and connectors required for the source power delivery and connections.

b. Provide required conduit, stub-in, junction and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per Plan Drawings and Specifications. Supply and install conduit between each of the aforementioned devices and between the electrical junction boxes, power supplies and access control equipment located on or above the door opening.

1) At wall mounted remote readers, provide conduit on the secured side of the door, 36- inches from the finish floor and 6-inches from the edge of the frame, to the related power supplies and access control equipment.

2) At electrical hardware power transfers provide conduit on the secured side of the opening from the power transfer, thru-wire hinge, or serviceable panel location on the frame jamb to the related power supplies and access control equipment.

c. Electrical Contractor to provide all 120VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

9. Access Control System Integrator to provide the following:

a. Low voltage wiring (12/24VDC) and communication cabling (RS-232/RS-485) from network control processors to reader controllers, I/O monitor/control interface

panels, electrified and integrated locking hardware, remote card readers, keypads, or display terminals, monitoring and signaling switches, and power supplies. Work includes related connectors, final terminations, and hook-ups required for a complete and functional access controlled opening in accordance with applicable Codes and specified system operational narratives.

10. Elevator Contractor to provide the following:
    a. Interface or landing of interface cable onto the elevator call button will be performed by a Certified Elevator Contractor.
    b. Coordinate with access control systems integrator provisions for a card reader with output allowing the elevator call button to be activated. A validated card read will be required for activation.
11. Full and seamless integration of the analog, digital or IP-enabled CCTV video surveillance system (Division 28) if applicable, with the installed site access control system software.
12. Full and seamless integration of the site intrusion alarm service and motion detector systems, (Division
13. 28) if applicable, with the installed site access control system software.
14. Final connections to fire alarm system, if required, by electrical and fire alarm system contractors.
15. Provide permits, submittals and approvals required by the authority having jurisdiction, prior to commencing with work.

PART 2 – PRODUCTS

2.1 SYSTEM ARCHITECTURE - ACCESS CONTROL SITE MANAGEMENT SYSTEM (ACSMS)

A. General: The ACSMS is a modular and networked based system providing physical access control security to a Wide Area District, campus or educational enterprise. The system to be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACSMS is to be alterable at any time depending on the Facility Requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote work stations. The ACSMS to include, but is not be limited to, the following features and functions:

1. An "Enterprise" class access control software application.
2. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
    a. The ACSMS to permit multiple instances of client software applications to run simultaneously on the network. The base system to include software application licenses with an unlimited number of licenses available subject to connection fees.
3. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.

Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.

4. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
    a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
    b. The ACSMS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
5. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid Codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
    a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.
6. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
7. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
8. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of card-holders into the database, and import/export of employee data.
9. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner Requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
10. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
11. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
12. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
13. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
14. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors over- riding scheduled access control restrictions and configurations if necessary.
15. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.

16. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.

17. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum number concurrent Users/Clients with software expansions to an unlimited number of workstations based on the Owners Network Requirements.

18. Systems Integration: The system to have the ability to be fully and seamlessly integrated with existing or specified intrusion detection alarm and video surveillance (CCTV) systems.

B. Open Architecture: The access control system infrastructure will be based on an open Architecture Design capable of supporting multiple Access Control Hardware Manufacturers and integrate with multiple non- proprietary network processors, controllers, interface modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

C. Network Support: Communication network connecting the central server host software modules, Client work- station software applications, and hardware controllers to be designed to support all of the following:

1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.

2. Direct-connected RS-232 and RS-485 communication cabling.

3. Dial-up modem connection using a standard dial-up telephone line.

2.2 MANUFACTURERS

A. Approved Access Control and Site Management System Manufacturers:

1. Corbin Russwin (Integrated Access Control Locking Devices and Accessories).

2. HID Global (Access Cards and Credentials, Remote Readers).

3. Sargent Manufacturing (Integrated Access Control Locking Devices and Accessories).

4. Securitron Corporation (Power Supplies).

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. General: Provide integrated access control door hardware and access control system equipment and accessories for each designated opening to comply with Requirements in this Section and with the Access Control Hardware Sets listed at the end of Part 3.

1. Access Control Hardware Sets: Requirements for quantity, item, model, design, grade, finish, size, and other distinctive qualities of each type of integrated door and access control hardware are indicated in the Access Control Hardware Sets at the end of Part 3.

2. Named Manufacturer's Products: Product designation and Manufacturer are listed for each door hard- ware type required for the purpose of establishing Minimum Requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. System Design: The equipment and materials supplied are to be standardized components regularly manufactured and utilized within the Source Manufacturer's access control systems.

1. System components to be non-proprietary in design and implementations, providing for an open protocol platform with multiple Manufacturers having functional software capable of integrating with the hardware specified. The installed integrated product is to be part of a single, cohesive management and access control system.

D. Substitutions: Requests for substitution and product approval for inclusive integrated access control door and access control systems hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Section 012500 - Substitution Procedures. Approval of requests is at the discretion of the Architect, Owner, and their Designated Consultants.

1. The access control system described in this specification represents a complete engineered system. If alternate products are submitted, it is the responsibility of the Supplier/Dealer/Integrator to provide an acceptable complete and working system layout, including re-engineering of elevation and wiring diagrams, as applicable. Complete systems to include at a minimum required power supplies, power transfers, and integrated access control locking hardware and accessories.

2.3 ACCESS CONTROL AND SITE MANAGEMENT SYSTEM HARDWARE

A. General: Provide all necessary access control field hardware devices required to receive alarms and administer all access granted/denied decisions. Field hardware devices must be designed and installed in accordance with applicable Electrical Codes.

B. Central Computer Host Server (Owner Provided): The central host server is interconnected to all system components, including client workstations and field installed controllers, providing operator interface, inter- action, display, control, and real-time monitoring.

2.4 INTEGRATED IP-ENABLED ACCESS CONTROL DEVICES

A. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Mortise Lock: IP enabled ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated credential reader, request-to-exit, and door position signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, ¾-inch projection latch bolt, and optional 1 inch steel deadbolt. Lock is UL listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - IN220 Series.
b. Mortise locks - IN220-ML20234 B OA BIP PSA M17 CT6R 626
c. Exit Devices - ED5200N IN220 PR9134 B OA BIP 5CH M110 CT6R 630 - Special App request for 5CH
d.
e. Fire-Rated Exit Devices - ED5200AN IN220 PR9134 B OA BIP 5CH M110 CT6R 630 - Special App request for 5CH
f. Substitutions: See Section 016000 - Product Requirements.

2. Operational Narratives required at ALL Card Access openings.

3. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.
4. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.
5. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand-alone operation in absence of network communication allowing for system operational redundancy.
6. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.
7. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
8. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC- enabled mobile phones, Bluetooth Smart-enabled mobile phones.

9. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.
10. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with IEEE 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.
11. Supports real-time system lockdown capabilities. Inside lever retracts latch bolt and deadbolt simultaneously.
12. High security mechanical key provides emergency override retraction of latch-bolt without need for electronic activation.
13. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.
14.

    Power Requirement: PoE Class 2, maximum 7 watts.

    Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.

    Bonding and Grounding: Meet or exceed TIA-607-B Requirements. Connect device ground cable to building electrical earth ground.

    Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C Requirements. CAT5e or higher (RJ45).

2.5 CABLES AND WIRING

A. Comply with Division 26 and 27

B. Data Line Supervision: System to include alarm initiation capability in response to opening, closing, shorting, or grounding of data transmission lines.

C. Install appropriate number of conductor pairs, in the wire gage (AWG) recommended by Manufacturer, corresponding to the electronic locking functions specified, amperage drawn and distances covered between the power supplies, power transfer devices, electrified hardware and access control equipment.

2.6 FABRICATION

Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to Manufacturers recognized installation standards for application intended.

2.7 ACCESS CONTROL HARDWARE FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain Manufacturers for their products.

B. Protect mechanical finishes on exposed surfaces from damage by applying temporary protective coverings before shipping.

C. Where specified, finishes on integrated card key locksets or exit hardware to incorporate an FDA recognized antimicrobial coating (i.e., MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with Requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of the installed access control system.

B. Examine roughing-in for electrical source power to verify actual locations of wiring connections before electrified and integrated access control door hardware installation.

C. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

D. Notify architect of any discrepancies or conflicts between the Specifications, Drawings and Scheduled access controlled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

Doors and frames at scheduled access controlled openings to be properly prepared to receive specified electrified and access control hardware and connections without additional in-field modifications.

3.3 INSTALLATION

A. Install each item of integrated access control door hardware and access control equipment to comply with Manufacturer's written instructions and according to Specifications.

B. Mounting Heights: Mount integrated access control door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with Governing Regulations:

1. Standard Steel Doors and Frames: DHI (LOCS).
2. Wood Doors: DHI WDHS.3.
3. Where indicated to comply with Accessibility Requirements, comply with CBC Chapter 11B.

C. Boxed Power Supplies: Verify locations.

1. Configuration: Provide the least number of power supplies required to adequately serve doors with access control hardware and equipment.

D. Integrated Wiegand access control products, campus locks, and IP enabled products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

E. Final connect the system control switches (integrated access control door hardware, remote readers, keypads, display terminals, biometrics), and monitoring, and signaling equipment to the related controller devices at each opening to properly operate the electrified door and access control hardware according to system operational narratives.

F. Retrofitting: Install each door hardware and access control item to comply with Manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface- mounted items until finishes have been completed on substrates involved.

G. Networked System Application Software: Install, and test application(s) software and databases for the complete and proper operation of systems involved. Assign software license(s) to Owner.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Perform a final inspection of the installed integrated access control door hardware and access control system and state in report whether installed work complies with or deviates from Requirements, including whether each component representing the opening assembly is properly installed, adjusted, operating and performing to system operational narratives.

B. Commissioning and Testing Schedule: Prior to final acceptance of the access control system installation, the following testing and documentation to be performed and provided to the Owner.

C. Inspection: Verify that units and controls are properly installed, connected, and labeled and that inter- connecting wires and terminals are identified.

D. Pre-testing: Program and adjust the system and pretest all components, wiring, and functions to verify they conform to Specified Requirements. Provide testing reports indicating devices tested, pass/fail status, and actions taken to resolve problem(s) on failed tests.

E. Acceptance Test Schedule: Correct deficiencies identified by tests and observations and retest until Specified Requirements are met.

F. Provide “As Designed” Drawings showing each device and wiring connection and electronic enclosure legends indicating cabling in and out.

G. Provide a complete set of operating instructions for access control hardware devices and a complete software user manual. The documentation includes module reference guides for each electronic enclosure.

3.5 ADJUSTING

Adjust and check each operating item of integrated access control door hardware, and each door opening to ensure proper secured operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

A. CLEANING AND PROTECTION

B. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all integrated access control door hardware at the latest possible time frame.

C. Clean adjacent surfaces soiled by access control system installation.

D. Clean operating items as necessary to restore proper finish and provide final protection and maintain conditions that ensure access control door hardware is without damage or deterioration at time of Owner occupancy.

3.6 DEMONSTRATION

Instruct Owner's Maintenance Personnel to adjust, operate, and maintain electronic integrated door hardware and the access control system.

3.7 ACCESS CONTROL HARDWARE SETSS

A. The hardware sets listed represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hard- ware and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Refer to Door Hardware Schedule for hardware sets.

END OF SECTION

SECTION 28 160 0 – INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other Specifications Sections and Drawings for related work required to be included as work under Division 26 0000, 27 0000, and 28 0000.
2. General Provisions and Requirements for electrical work.

1.2 PERFORMANCE REQUIREMENTS AND SCOPE

All intrusion detection equipment as specified herein is future and is indicated for reference only. Provide all conduit outlet boxes and power connections only for all devices as indicated on the Drawings.

PART 2 - PRODUCTS

2.1 SYSTEM FUNCTIONS

A. Provide provisions only for a complete supervised Intrusion Detection System as shown on the Plans including but not limited to master control panel, key pad stations, motion detectors, connections to door switches, a State Fire Marshal listed digital communicator and an automatic dialer.

B. Upon detection of an intruder by initiation of any device in the system, the system shall cause the annunciator LED to light and sound an alarm signal on the School's telecommunication system. Alarm information shall be sent by digital dialer to Central Station Alarm Monitoring Agency.

C. Systems shall detect the motion of a body taking not more than four steps in an area secured with motion detection equipment where entry doors or windows are possible access.

D. Each building area shall be on a separate zone with each zone controlled separately so that any building area may be secured while others remain unsecured.

E. The System shall be capable of off-site computerized access for remote access, programming and control.

2.2 CONTROL PANEL

A. Control/Communicator Panel shall be a DMP #XR-500N control panel with an integral digital communicator and shall be Underwriters Laboratories listed. All external circuit connections shall be UL listed as power limited in accordance with the provisions of Article 760 of the California Electrical Code (CEC).

1. Provide Point of Protection (POPEX) modules at the control panel for Popit module supervision.
2. Provide Point of Protection Identification Transponders (Popit) modules at building terminal cabinets to individually identify each detector in the system.

B. The Control/Communicator shall be IP based.

C. System shall include the following features:

1. Real time clock and test timer.
2. Battery charging circuit.
3. Battery voltage supervision.
4. Supervised automatic reset circuit breakers.
5. Onboard warning buzzer and diagnostic LEDs.
6. Automatic answer modem.
7. Lightning and RFI protection.
8. Central Station reporting format.
9. Printer/CRT interface module for on-site serial data printer recording or CRT display of events.
10. Quad serial output module for enhanced serial data interface capability for specific accessory modules and devices.
11. Individual zone responses.
12. Custom annunciator text.
13. Audible alarm output, steady or pulsed.
14. Automatic silencing.
15. Attack-Resistant enclosure and lock meeting Underwriters Laboratory Local Burglary requirements.
16. A minimum of eight auxiliary form "C" dry contacts for a variety of programmable responses to alarm and trouble conditions.
17. Transformer enclosure for internal mounting of Class 2 transformer.
18. Two telephone numbers with selective signaling options.
19. Individual zone responses.
20. Automatic test reports.

2.3 BAR-CODE

Bar-code programmer for diagnostics and programming capability.

2.4 RECEIVER

A. Receiver shall be Bosch Security System #D6600 Series, UL listed for fire and intrusion detection.

B. Provide a 50VA Class 2 plug in transformer for power input.

C. System shall contain 48 hours of standby power utilizing rechargeable sealed lead acid batteries and a battery charger.

D. System shall be FCC approved for telephone connections.

E. An alphanumeric LCD Display shall indicate account number, area number, time, date, event, zone or point number, line or group number, status and external devices.

F. Twenty-four hour Clock and 128 year calendar.

G. Forty Character Line internal printer and interface capability with an external serial printer.

H. Transmission Verification appropriate with the format utilized.

I. Storage of 249 separate events.

J. Transmission Format shall support the control panel.

K. Turn the Receiver over to the District for Central Station or Campus Monitoring.

2.5 REMOTE ACCOUNT MANAGER

A. System shall be Bosch Security Systems #D5300 Series or equal with all equipment necessary for computerized access, programming, diagnostics, and remote control of the system. It shall be possible to remotely change passcodes, locate faults, shunt problem zones, arm and disarm the system, silence alarms, and control the auxiliary output contacts in the control panel.

B. System shall permit remote diagnostics including utility and battery power conditions, phone line condition, event memory by zone, and current clock and calendar settings.

C. System shall be 100% IBM compatible for use with personal computers.

D. System shall include a plug-in modem and software necessary for a complete and operable installation. Furnish the District with a Software License Agreement for updated software enhancements as they develop.

2.6 KEYPADS

A. Master Keypad shall be DMP or equal capable of displaying system status and controlling the alarm system. Unit shall receive its operating power from the main control panel. Keypad shall be flush-mounted on a wall near the entry doors of each building. Faceplate shall be brass or stainless steel as selected by the Architect.

B. Sub-Zone Keypads shall be DMP or equal to allow individual zones to be bypassed. Keypad shall be flush wall where shown on Plans Faceplate shall be brass or stainless steel as selected by the Architect.

2.7 MOTION SENSORS

Motion sensors shall be Honeywell DT-7450 with Bosch B328 mounting bracket. Sensors shall be dual performance, dual event devices to minimize false alarms or equal passive infrared devices detecting thermal motion signals. Sensor coverage patterns shall be as required for optimum coverage at each individual location. Sensor shall be adjustable Gimbal mounted with plate and outlet box. Provide an attack resistant enclosure DS AE774 at Multipurpose and Gymnasium areas.

2.8 MAGNETIC SWITCH

Magnetic switch shall be fully concealed in the door frame, Admeco, Sentrol or equal.

2.9 INTRUSION DETECTION SYSTEM

Each Intrusion Detection System terminal cabinet shall contain a power supply for motion sensors and/or POPIT/POPEX (Zonex) modules.

2.10 CABLING

Cabling shall be as required for system operation. All cabling shall be shielded.

2.11 SIREN

Siren shall be ATW (Mascon) PR-D550PW or equal.

PART 3 - EXECUTION

3.1 MOTION SENSORS

Locate motion sensors to provide optimum coverage of the space and to avoid conflicts with the architectural aesthetics of the building. Submittal Drawings shall show the exact locations of all system sensors and keypads for approval by District's Maintenance Managers.

3.2 CONCEALED DOOR SWITCH

Coordinate concealed door switch installations with Finish Hardware Manufacturer.

END OF SECTION

SECTION 28 23 00 - VIDEO MONITORING AND SURVEILLANCE SYSTEM (CCTV)

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Digital Video Monitoring and surveillance system, including card access control systems. System components include cameras, terminal cabinets, conduits, cables, monitors, switchers, digital video recorders, connectors, speaker/microphones, combiners, sound activated monitor base station with listen/talkback amplifier companion, call stations, alarming base station, and other materials and equipment.

B. Video surveillance system shall be integrated with existing Integrated Security Management and Monitoring System (ISMS).

1.02 RELATED SECTIONS

A. Applicable Division 1 sections

B. Section 26 05 00: Common Works Results for Electrical

C. Section 26 05 13: Basic Electrical Materials and Methods.

D. Section 26 05 26: Grounding and Bonding

E. Section 26 05 33: Raceways and Boxes Fittings and Supports.

F. Section 26 24 16: Panelboards and Signal Terminal Cabinets

G. Section 2652 00: Emergency Power Systems.

H. Section 27 05 36: Cable Trays for Communications.

I. Section 27 10 15 Pemises Wiring New Installation

J. Section 28 10 00 Access Control System (ACS)

1.03 REFERENCES

A. IEC/EN/UL 60950-1: – Information Technology Equipment - Safety - Part 1: General Requirements

B. IEC/EN/UL 60950-22: Technology Equipment Safety – Part 22: Equipment to be Installed Outdoors

C. SMPTE 296M (HDTV 720p) - 1280 x 720 Progressive Image Sample Structure – Analogue and Digital Representation and Analogue Interface.

D. SMPTE 274M (HDTV 1080p) - 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates.

E. SMPTE ST 2036-1 (UHDTV): Ultra High Definition Television (UHDTV)

F. ISO/IEC 14496-10 Advanced Video Coding (H.264) – Advanced Video Coding (H.264)

G. IEEE 802.3at (Power over Ethernet Plus) – Power over Ethernet Plus

H. IEEE 802.1X (Authentication) – Standard for Local and metropolitan area networks-Port-Based Network Access Control (Authentication)

I. IPv4 (RFC 791) – Internet Protocol Version 4

J. IPv6 (RFC 2460) – Internet Protocol Version 6

K. QoS – DiffServ (RFC 2475) – Scalable End-to-End Quality of Service Model

L. Relevant ONVIF “S”profile as defined by the ONVIF Organization.

M. IEC/EN 60529 IP66 (Ingress protection) – Degrees of Protection Provided by Enclosures (IP Code)

N. NEMA 250 Type 4X – Enclosures for Electrical Equipment

O. IEC/EN 62262 IK10 – Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

1.04 SUBMITTALS

A. List of Materials: Submit a complete list of proposed materials.

B. Shop Drawings: Provide detailed and dimensioned Shop Drawings indicating kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of parts or modules, sizes, and complete details of method of fitting suspension and fastening luminaires in place. Provide wiring and cabling diagrams. Drawings shall contain sufficient information to assemble and install equipment at the Project site without further instructions.

C. Installation Instructions: Submit manufacturer's written installation instructions for luminaires and accessories.

1.05 SUBSTITUTIONS

A. Equipment and materials that deviate from these requirements shall not be accepted without written approval from OWNER’S Information Technology project manager. When deviating or proposing material substitutions the following information shall be submitted:

1. Substitution request form substantiating reasons and benefits to OWNER, and all necessary documents to validate the claims made in the substitution form.

2. Submittals must comply with contract general provisions.

B. The CONTRACTOR assumes all responsibility for additional costs, directly or indirectly, associated with proposing and installing an approved substitution products. All substituted products must meet the intent of form and function identified in the specification.

1.06 QUALITY ASSURANCE

A. The CONTRACTOR or security sub-CONTRACTOR shall be a licensed security CONTRACTOR with a minimum of five (5) years’ experience installing and servicing systems of similar scope and complexity, and evidence that CONTRACTOR has completed at least three (3) projects of similar scope, and is currently engaged in the installation and maintenance of systems herein described.

B. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.

C. The CONTRACTOR or designated sub-CONTRACTOR shall submit installer's third party verified credentials of completion of manufacturer certification. The CONTRACTOR system programmer shall have attended manufacturer training and obtained the highest level certifications for the ISMS, ACS and VMS.

D. The CONTRACTOR shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system.

E. The video surveillance system shall be in compliance with applicable industry standards listed under article 1.03-References.

1.07 WARRANTY

A. CONTRACTOR shall warranty that all work executed and materials furnished shall be free from defects in materials and workmanship for a minimum period of five (5) years from date of installation acceptance, excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. In the event a manufacturer's warranty is longer than five (5) years, the manufacturer's warranty shall be the warranty period. Immediately upon receipt of written notice from the OWNER, the CONTRACTOR shall repair or replace at no expense to the OWNER, any defective material or work that may be discovered before final acceptance of work or within the warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of, or failure to, examine work by the OWNER shall not relieve CONTRACTOR from these obligations.

B. Warranty shall provide the OWNER direct access to manufacturer Technical Assistance Center (TAC), software updates, and defect support.

C. Manufacturer of provided equipment shall guarantee availability of parts common to provided system and/or full replacement units, for a period not less than 5 years. Parts for the supplied systems shall be available within 30 calendar days during the 5 year period.

D. Installation CONTRACTOR shall install all equipment in accordance with manufacturer's specifications and recommendations necessary to ensure continuation of the manufacturer's warranty. If the installation CONTRACTOR cannot install manufacturer's equipment in such a manner, it is the responsibility of the installation CONTRACTOR to provide written, timely notification to OWNER ITD Project Management.

E. OWNER monitors equipment service records and failure rates. In the event that the OWNER determines that a LAN system component, or model part, provided through this specification exceeds acceptable failure rate, or repeated failure rate, the CONTRACTOR shall replace all systems of the same model purchased through this procurement with a new model that meets or exceeds the same functional requirements. Units or components exceeding either the acceptable or repeated failure rates shall be known as a "mass failure." The CONTRACTOR shall provide qualified technicians to install the replacement systems and a project manager to coordinate replacement schedule with ITD. Replacement of mass failing systems, labor, and project management shall be provided and completed in accordance with this specification and related OWNER installation guidelines at no additional cost to the OWNER.

F. The acceptable failure rate/repeat failure rate for a single system model or individual modular model part, at a single site, or OWNER-wide, shall be:

G. Equal to or less than 10% in any 12 month period during the original warranty term.

H. Equal to or less than 15% cumulative failures during the entire term of the original warranty.

I. If, at any time during of the warranty term, the failure rate of the LAN systems or components exceeds 10%, the CONTRACTOR shall extend the original warranty term by one year, at no additional cost to the OWNER.

J. The CONTRACTOR is responsible for replacement of any failed equipment provided by the CONTRACTOR, during the warranty period or the extended warranty period. This includes equipment that falls under the “mass failure” definition.

K. In the event of a “mass failure” the CONTRACTOR shall replace all units and/or components affected within 60 days or written notification from the OWNER.

L. Upon replacement of each unit or component, the replaced unit warranty shall continue as if the original equipment were still in service.

M. The warranty shall cover the complete system including fan assembly, power supplies, and the device itself.

N. The warranty shall include onsite 48-hour advanced part replacement.

O. The warranty shall include all labor to service and/or replace warranted system(s).

P. In the event any Supplier or manufacturer offers additional warranty, at no additional cost, beyond that specified herein, CONTRACTOR shall state the terms of such warranty or warranties in writing and shall extend the same to the OWNER without additional cost.

Q. Equipment manufacturers shall have E-mail trouble reporting and response mechanisms in place and a toll free 24-hour help center to assist with troubleshooting and operation of the equipment at no additional cost to the OWNER, or as part of the warranty.

PART 2 – PRODUCTS

2.01 CAMERAS AND CAPABILITIES

A. General Requirements:

1. System overall shall be capable of intelligent video analytic and triggers actions based on programming requirements.
2. Cameras shall be IP-based and comply with established network and video standards.
3. Cameras shall support true day/night vision modes using IR cut filters.
4. Camera enclosure shall be rated as follow;
   a. Vandal resistance – IK10
   b. Ingress protection – IP67, NEMA 4X, or higher
5. The primary power source of cameras shall be powered by data nework switches equipped with PoE/PoE+/UPoE capabilities as specified by Section 27 1018 10G Local Area Network (LAN) Systems. The secondary power sources (e.g. injectors, midspans, local power) shall be reviewed and approved by OWNER on a case by case basis.
6. Cameras shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration

of functionality into third party applications. Manufacturers SDK (software development kit) must be available to the general public.

7. Cameras shall be in conformance with profile S as currently defined by the ONVIF Organization (www.onvif.org/conformant-products) including firmware upgrade to meet future revisions.

8. Camera types listed below describing various resolutions, form-factor and features shall be supplied by a single manufacturer per site, and meet or exceed the following requirements:

    a. The camera shall be equipped with IR progressive scan sensor.

    b. The camera shall provide true day/night functionality.

    c. The camera shall be equipped with shall provide local video storage (e.g. a microSD/microSDHC/microSDXC memory card expansion).

9. The camera shall allow for video to be transported over:

    a. HTTP (Unicast)

    b. HTTPS (Unicast)

    c. SRTP (Unicast & Multicast)

    d. RTP over RTSP (Unicast)

    e. RTP over RTSP over HTTP (Unicast)

10. The camera shall support Quality of Service (QoS) for traffic prioritization.

11. User Interface shall comply with the following:

    a. The camera shall contain a built-in web server making video and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software or specialty plugins

    b. The camera shall be accessible via camera IP address directly using client software supported by the equipment manufacturer

12. Protocol Requirements:

    a. At the minimum, camera shall incorporate support for IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, SRTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, ARP, DNS, DynDNS, SOCKS, SSH, NTP, CIFS/SMB.

13. Text overlay requirement:

    a. Provide embedded on-screen text with support for date & time, and a customer-specific text, camera name, minimum of 45 ASCII characters.

    b. Provide the ability to apply privacy masks to the image.

    c. Allow for the overlay of a graphical image, such as a logotype, into the image.

14. Security

a. The camera shall support the use minimum of 128 bit encryption for secured authentication and communication of both administration data and video streams.

b. The camera shall support IEEE 802.1X authentication.

c. The camera shall provide support for restricting access to pre-defined IP addresses only.

d. The camera shall restrict access to the built-in web server by usernames and passwords at three different levels.

e. The camera shall not allow third party firmware to be loaded onto the camera.

15. The camera shall be equipped with basic intelligent video analytic functionality that can be triggered by:

a. Intelligent Video Detection

b. Audio Detection (optional)

c. Live Stream Accessed

d. Camera tampering

e. Auto tracking

f. Scene alteration detection (e.g. removed object detection)

16. Response to triggers shall include capability of:

a. Send SNMP trap or email notification

b. Send images, using FTP, HTTP, HTTPS, network share or email

c. Send video clip, using FTP, HTTP, HTTPS, network share or email

17. The camera shall incorporate a function for image stabilization

18. The camera shall provide remote focus, remote zoom, and alignment

19. Hardware interface requirements

a. Network interface

1) The camera shall be equipped with one (1) auto-negotiating10/100 Base-T Ethernet port.

20. Environmental operational requirements

a. Operate in a temperature range of -40 °C to +60 °C (-40 °F to 140 °F).

b. Operate in a humidity range of 10–100% RH (condensing).

21. Installation and maintenance:

a. The camera shall be supplied with management software which allows the assignment of IP addresses, upgrade of firmware and backup of the cameras' configuration.

b. The camera shall allow updates of the software (firmware) remotely over the IP network infrastructure.

c. The camera shall provide Autorotation functionality.

B. Type 1 Camera Requirements

1. Illumination: The camera shall meet or exceed the following illumination specifications:
   a. Color: 0.3 with WDR image processing capability;
   b. B/W: 0.02 lux with WDR image processing capability
2. Target Resolution:
   a. Ability to distinguish an object from background within 125 feet (*)
   b. Provide 20 pixels per linear foot. Contractor shall provide a pixel count per linera foot.
3. Encoding - The camera shall support the following video encoding algorithms:
   a. Compression Format:
      1) Motion JPEG
      2) H.264 (Baseline/Main/High Profiles)
      3) The camera shall provide configurable compression levels.
   b. The camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate spikes the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

B. Type 2 Camera Requirements

1. Illumination: The camera shall meet or exceed the following illumination specifications:
   a. Color: 0.1 lux with WDR image processing capability. Minimum WDR of 120 db.
2. Target Resolution:
   a. Ability to classify an object class within 95 feet.
   b. Provide 40 pixels per linear foot.
3. Encoding - The camera shall support the following video encoding algorithms and format:
   a. Motion JPEG
   b. H.264 (Baseline/Main/High Profiles)
   c. The camera shall provide configurable compression levels.
   d. The camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate spikes the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

C. Type 3 Camera Requirements:

1. Illumination: The camera shall meet or exceed the following illumination specifications:
   a. Color: 0.2 with WDR image processing capability and minimum WDR of 120 db.
   b. B/W: 0.008 lux with WDR image processing capability and minimum DWR of 120 db.
2. Target Resolution:

a. Ability to describe the object in details within 45 feet.

b. Provide 80 pixels per linear foot.

c. The camera shall provide both landscape format (4:3 and 16:9 aspect ratio) as well as corridor format (3:4 and 9:16 aspect ratio).

3. Encoding:

a. The camera shall support the following video encoding algorithms and format:

1) Motion JPEG

2) H.264 (Baseline/Main/High Profiles)

3) The camera shall provide configurable compression levels.

b. The camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate spikes the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

D. Onboard Camera Minimum Requirements:

1. Electronic day/night

2. Meet EN 50115 (vibration and shock) and ISO 16750-3

3. Maximum power consumption: 4 watts

4. Illumination: The camera shall meet or exceed the following illumination specifications:

a. Minimum sensitivity of 1.0 lux with WDR image processing capability; (with minimum WDR of 70db)

5. Target Resolution:

a. Ability to describe an object in details within 45 feet.

b. Provide 80 pixels per linear foot.

6. Encoding - The camera shall support the following video encoding algorithms:

a. Compression Format:

1) Motion JPEG

2) H.264 (Baseline/Main/High Profiles)

3) The camera shall provide configurable compression levels.

b. The camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate spikes the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

2.02 NVR AND RELATED COMPONENTS

A. NVR general requirements where required, Project cameras shall be connected to existing Security system, otherwise provide per below as required.:

1. The NRVshall be based on a true open architecture that shall allow the use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.

2. The NVR shall be a pre-assembled appliance solution, or software based supporting VM (e.g. VMWare, Microsoft hypervisor). Other solution platforms be reviewed and approved by theOWNER on the case by case basis.
3. The NVR shall be an IP enabled solution. All communication with the VSS system shall be based on standard TCP/IP protocol and have the capability to use network security.
4. The NVR shall provide minimum of two (2) 1Gbps Ethernet network ports
5. The NVR shall support user authentication with claims-based authentication using external providers.
6. The NVR shall offer a complete and scalable video surveillance solution that shall allow cameras to be added on a unit-by-unit basis.
7. The NVR shall interface with analog-to-digital video encoders and IP cameras.
8. All video streams supplied from analog cameras or IP cameras shall be digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, H265, Wavelet, or JPEG2000 compression formats and recorded simultaneously in real time.
9. All audio streams supplied from IP video servers shall be digitally encoded in G.711 (u-law), G.721, G.723, or AAC compression formats and recorded simultaneously in real time.
10. Each camera's bit rate, frame rate, and resolution shall be set independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.
11. The NVR shall to support support only secured media stream requests, unless explicitly configured otherwise. Or have the capability to laverage network security cotrols. Secured media stream requests shall be secured with strong certificate based authentication leveraging RTSPS (aka RTSP over TLS). Client authentication for media stream requests is claims-based and may use a limited lifetime security token.
12. The NVR shall have the cability to encrypt the media stream, including video, audio, and metadata with authenticated encryption for transmission. Media stream encryption shall be done at rest and in transit and be a certificate based AES 128b bits encryption. The VMS shall:
    a. Allow encryption to be set on a per camera basis for all or some of the cameras.
    b. Allow encrypted streams to be exported.
13. The NVR shall support end to end encrypted streams with cameras supporting Secure RTP (SRTP) both in unicast and multicast from the camera.
14. The NVR shall be able to use multiple VSS keyboards to operate the entire set of cameras throughout the system, including brands of cameras from various manufacturers and including their PTZ functionalities.
15. The NVR shall be able to retrieve and set the current position of PTZ cameras using XYZ coordinates.
16. The NVR shall support PTZ camera protocols from multiple manufacturers, including analog and IP protocols.
17. The NVR shall arbitrate the user conflict on PTZ usage based on user levels per camera.

18. The NVR shall support Audio and Video storage configuration for the NVR shall support:
    a. Internal or external computer data storage in RAID 0, 1, 5, 6, or 10 configuration.
    b. Within the overall storage system, the Audio and Video shall have the capability to include disks located on:
        1) Local.
        2) Network Attached Servers (NAS).
        3) Storage Area Networks (SAN).

B. NVR RECORDING FUNCTION

1. The Recorder shall use an event and timestamp database for the advanced search of audio/video archives. This database shall use a SQL database.
2. The Recorder shall protect archived audio/video files and the system database against network access and non-administrative user access.
3. The Recorder shall digitally sign recorded video using 248-bit RSA public/private key cryptography.
4. The Recorder shall have the capacity to configure the key frame interval (I-frame) in seconds or number of frames.
5. The Recorder shall provide a pre-alarm and post-alarm recording option that can be set between one second and 5 minutes on a per camera basis.
6. The Recorder shall provide the functionality of storing of video and audio streams based on triggering events, such as:
    a. Digital motion detection.
    b. Digital input activation.
    c. Macros.
    d. Through SDK application recording.
7. The Recorder shall be capable of intelligent video analytic detection on each individual camera leveraging management template or levearage external server video analytics. Detection can be set into four different modes:
    a. Full Screen: All 1320 blocks on screen are activated and a general threshold for the overall detection in the entire image can be set, and when it is reached, it can trigger recording and a motion event or a custom event.
    b. Full Screen Unit: This is the same as the Full Screen but the motion detection takes place in the DVS.
    c. Detection Zone: Six overlapping zones can be defined in the 1320 blocks on screen with each of these zones having its own threshold, and, when that threshold is reached, each one of them can trigger recording and a motion event or a custom event. Each zone triggering its own event allows for the configuration of directional motion detection events and other complex motion detection logic.
    d. Detection Zone Unit: This is the same as the Detection Zone, but the motion detection takes place in the DVS and only one zone is supported.

e. Disabled: No motion detection is performed on this camera.

8. The Recorder shall allow for multiple recording schedules to be assigned to a single camera. Each schedule shall be created with the following parameters:

   a. Recording mode:

      1) Continuous.

      2) On Motion/Manual.

      3) Manual.

      4) Disabled.

   b. Recurrence pattern:

      1) Once on specific days.

      2) Specific days on a yearly basis.

      3) Specific days on a monthly basis.

      4) Specific days on a weekly basis.

      5) Daily.

   c. Time coverage:

      1) All day.

      2) Specific time range(s).

      3) Daytime or night time based on the times of sunrise and sunset that are automatically calculated from the time of year and a geographical location. Provision shall be given to offset the calculated sunrise or sunset time by plus or minus 3 hours.

9. The Recorder shall allow each camera (video source) to be encoded multiple times for each camera stream in the same or different video formats (MPEG-4, MPEG-2, MJPEG, H.264, H.265, Wavelet or JPEG2000), limited only by the capabilities of each DVS.

10. The Recorder shall have the capacity to manage up to 10,000 video endpoints from one operation manager.

11. The Recorder shall allow users to view up to 5 million camera feeds across a federation model.

12. The Recorder shall have open APIs allowing integration into 3rd party applications, internally development applications and/or data connectivity for deeper analytics.

13. Whenever multiple video streams are available from the same camera, users shall be free to use any one of them based on their assigned usage. The standard video stream usages are:

    a. Live.

    b. Recording.

    c. Remote.

    d. Low resolution.

    e. High resolution.

14. The Recorder shall allow the video quality to vary according to predefined schedules. Such schedules shall have the same configuration flexibility as the recording schedules mentioned earlier. The video quality shall be based on, but not limited to, the following parameters:
    a. Maximum bit rate.
    b. Maximum frame rate.
    c. Image quality.
    d. Key frame interval.
15. The Recorder shall have the ability to dynamically boost the quality of the "recording stream" (see previous bullet) based on specific events:
    a. When recording is started manually by a user.
    b. When recording is triggered by a macro, an alarm or detected motion.
16. The Recorder shall have the capacity to communicate using 128 bits SSL encryption and HTTPS secure protocol.
17. The Recorder shall have the capacity to redirect audio/video streams to active viewing clients on the network using unicast UDP or TCP.
18. The Recorder shall empower the administrator with a full range of disk management options:
    a. The Recorder shall allow the administrator to choose which disks to use for RECORDING and to set a maximum quota for each.
    b. The Recorder shall allow the administrator to spread the RECORDING of different cameras on different disk groups (groups of disks controlled by the same controller) so that RECORDING could be carried out in parallel on multiple disks.
19. The Recorder shall offer the following options to clean up old archives, on a camera by camera basis:
    a. After a preset number of days.
    b. Write over the oldest archives first when disks are full (FIFO – First In First Out).
    c. Stop RECORDING when disks are full.
20. The Recorder shall allow important video sequences to be protected against normal disk cleanup routines.
21. Users shall have the following options when protecting a video sequence:
    a. Until a specified date.
    b. For a specified number of days.
    c. Indefinitely (until the protection is explicitly removed).
22. The Recorder shall allow the administrator to put a cap on the percentage of storage space occupied by protected video.
23. The Recorder shall have the capacity to down-sample video streams for storage saving purposes. The down-sampling options available are the following:

a. For H.264, MPEG-4, and H.265, streams the down-sampling options are: all key frames, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame.

b. For MJPEG streams the down-sampling options are: 15 fps, 10 fps, 5 fps, 2 fps, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame.

C. VMS CLIENT USER INTERFACE (UI)

1. The Client Application shall provide the user interface for VSS configuration and monitoring over any network and be accessible locally or from a remote connection.
2. The Client Application shall provide an easy-to-use graphical user interface (UI).
3. The Client Application shall allow users to access up to 10,000 video end points.
4. The Client Application shall allow users the capability to access up to 5 million video end points when in federator type of architecture.
5. The client application for monitoring shall support running oin 64-bit mode.
6. Logging on to a Client Application shall be done either through locally stored user accounts and passwords the operator's credentials when Active Directory integration is enabled.
7. When integrated with Microsoft's Active Directory, the Client Application shall authenticate users using their Active Directory credentials.
8. The Client Application shall fulfill the role of a Unified Security Interface that is able to monitor intrusion detection and access control events and alarms, as well as view live and recorded video.
9. The Client Application shall provide a graphical user interface to control and monitor VSS. It shall allow administrators and operators with appropriate privileges to monitor their unified security platform, run reports, and manage alarms.
10. The Client Application shall include advanced video capabilities, including:
    a. Advanced live video viewing functionality.
    b. Advanced archive playing and video playback functionality.
    c. Monitoring and management of video system events and alarms.
    d. Intercom or duplex audio or SIP based application.
    e. Generation of video reports.
    f. Control of PTZ cameras.
    g. Creating and monitoring archive transfer requests.
    h. Display metadata overlaid on live or playback video.
11. The live video viewing capabilities of the Client Application shall include:
    a. The ability to display all cameras attached to the NVR's.
    b. Support for live video monitoring on each and every display tile within a task in the user's workspace.
    c. The ability to drag and drop a camera into a display tile for live viewing.

d. The ability to drag and drop a camera from a map into a display tile for live viewing.

e. Support for digital zoom on live camera video streams.

f. The ability for audio communication with video units with audio input and output.

g. The ability to control pan-tilt-zoom, iris, focus, and presets.

h. The ability to bookmark important events for later retrieval on any RECORDING camera and to uniquely name each bookmark in order to facilitate future searches.

i. The ability to start/stop recording on any camera in the system that is configured to allow manual recording by clicking on a single button.

j. The ability to activate or de-activate viewing of all system events as they occur.

k. The ability to switch to instant replay of the video for any RECORDING camera with the simple click of button.

l. The ability to take snapshots of live video and be able to save or print the snapshots.

m. The ability to view the same camera multiple times in different tiles.

12. The video playback (archive playing) capabilities of the Client Application shall include:

a. Support for audio and video playback for any time span.

b. Support for video playback on each and every display tile.

c. The ability to instantly replay the video for any RECORDING camera with the simple click of a button.

d. The ability to select between instant synch of all video streams in playback mode, allowing operators to view events from multiple angles or across several camera fields, or non-synchronous playback.

e. The ability to simultaneously view the same camera in multiple tiles at different time intervals.

f. The ability to control playback with:

1) Pause.

2) Lock Speed.

3) Forward and Reverse Playback at: 1x, 2x, 4x, 6x, 8x, 10x, 20x, 40x, 100x.

4) Forward and Reverse Playback frame by frame.

5) Slow Forward and Reverse Playback at: 1/8x, 1/4x, 1/3x, 1/2x.

6) Loop playback between two time markers.

13. The ability to display a single timeline or one timeline for each selected video stream, which would allow the operator to navigate through the video sequence by simply clicking on any point in the timeline.

14. The ability to display the level of motion at any point on a timeline.

15. The ability to clearly display bookmarked events on the timeline(s).
16. The ability to query archived video using various search criteria, including, but not limited to, time, date, camera, and area.
17. The tool necessary for searching video and associated audio based on user- defined events or motion parameters.
18. The ability to define an area of the video field in which to search for motion as well as define the amount of motion that will trigger search results with the client or with intelligent video analytics. The Client Application shall then retrieve all archived video streams that contain motion that meets the search parameters. There shall be a graphical timeline on which the time of each search hit shall be indicated.
19. The ability to browse through a list of all bookmarks created on the system and select any bookmarked event for viewing.
20. The ability to add bookmarks to previously archived video for easier searching and retrieval.
21. Support for digital zoom on playback video streams.
22. Still image export to PNG, JPEG, GIF, and BMP format with Date and Time stamp, and Camera Name on the image (snapshot).
23. Tools for exporting video sequences in standard video formats, such as ASF.
24. The ability to encrypt exported video files.
25. The ability for an operator to load previously exported video files from their computer or network.
26. The ability for queries to be saved upon closing the Client Application and reappear when the application is reopened.
27. The ability to dynamically block, on demand, video stream dynamically to lower level users to prevent access, for a specific time, to live and recorded video.
28. A tool building and exporting a set of videos into a single container. This tool shall allow the operator to build sequences of video to create a storyboard and allow the export of synchronous cameras.
29. The ability to store the video export and still image export at a pre-defined storage location.
30. An interface with the ability to list, search, and manipulate previously generated video exports.
31. The ability to export sequences of video in open standards including ASF and MP4
32. Visual Tracking
    a. The Client Application shall support the ability to manually track a moving target with the single click of a button.
    b. The ability to switch from one camera view to an adjacent camera shall be done within a single display tile.
    c. Switching between camera streams shall be accomplished by simply clicking on a semi-transparent shape or overlay.
    d. Visual tracking shall be available with both live and recorded video.

D. WEB CLIENT

1. The VSS shall provide a desktop application and a web client interface for configuration, management, and/or viewing.
2. The web client shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.
3. The web client shall be platform independent and run within Microsoft Internet Explorer, Firefox, Safari, and Google Chrome.
4. Video Stream shall be redirected to the Web Client with no stream transformation or re-encoding for all streams in H264, H265, and Mpeg4 ISO.
5. The CONTRACTOR shall provide up to 10 number of simultaneous Web Clients.
6. Functionalities:
    a. Login using name and password or Active Directory support shall be available.
    b. Encrypted communications for all transactions.
    c. Print reports and export to CSV file.
    d. Video
        1) Live and playback video at 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps.
        2) Video export.
        3) 1, 4, 6 or 9 tiles.
        4) Basic PTZ Controls (Pan/Tilt, Zoom, go to presets, start pattern).
        5) Start / Stop recording.
        6) Alarm report.

E. MOVILE APPLICATION GENERAL REQUIREMENTS

1. The VSS shall support mobile apps for various off-the-shelf smartphones and tablets. The mobile apps shall communicate with the Mobile Server of the VSS over any WiFi or mobile network connection.
2. Mobile apps shall communicate with the VSS via a Mobile Server. Communication between the mobile device and the Mobile Server shall support optional encryption.
3. Supported manufacturers shall include:
    a. Apple IOS devices.
    b. Android based tablets and Smartphones.
    c. Microsoft Windows based devices.
4. It shall be possible to download the mobile apps from the Central application store (Apple iTunes App Store, Google Play, Windows Store).
5. Functionalities:
    a. Live monitoring and command and control of the VSS.
    b. Receive alarm push notifications from the Apple Push Notification Server or from the Google Android push server.

c. Alarm management (view and acknowledge alarms, video tied to alarms).

d. View VSS hierarchy and search for entities.

e. Stream video from the mobile device using the built-in camera.

f. Video streams from mobile devices shall be available in the VSS to be viewed in live and recorded on the Archiver.

g. Video system shall provide the following:

1) View live and playback video at 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps.

2) Monitor camera status.

3) View up to 6 video feeds.

4) Control PTZ functionality of a camera, including access to PTZ presets.

5) Save snapshots locally on the device.

6) View video tied to access control events, and alarms.

PART 3 - EXECUTION

3.01 DEPLOYMENT

A. Deployment Management Service

1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the CONTRACTOR and the vendor organization and who will be responsible for:

a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's ISMS.

b. Providing a project plan for the deployment of the vendor's ISMS.

c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's ISMS (if applicable).

d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor’s ISMS.

e. Coordinating and scheduling the vendor field services with the CONTRACTOR to assist with the deployment of the vendor’s ISMS.

f. Providing regular project status updates to the CONTRACTOR regarding the development of custom solutions (if applicable) and the deployment of the vendor’s ISMS.

2. System Configuration and Commissioning Service. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:

a. Assisting the CONTRACTOR’s or subcontractor’s onsite/remote technicians with the configuration and commissioning of the vendor’s ISMS at the client site.

b. Conducting a test of the ISMS following the deployment of the system using real-world operator scenarios to ensure optimal system performance.

c. Providing the CONTRACTOR with a Service Report detailing the tasks completed during the deployment of the ISMS at the client site, as well as any recommendations for improving the performance of the ISMS that must be implemented by the CONTRACTOR.

d. Providing a knowledge transfer of the vendor's ISMS to the CONTRACTOR following the deployment of the ISMS at the client site.

3.02 INSTALLATION

A. The CONTRACTOR or subcontractors main resources within the project shall carry proper professional certification issued by the manufacturer and verified by a third party organization to confirm sufficient product and technology knowledge.

B. The CONTRACTOR shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate system.

C. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

D. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer, or of a version as specified by the integrator of the VSS system.

E. All equipment requiring users to log on using a password shall be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

F. A proper installation shall meet NEC (National Electrical Code) per the guidelines of that year’s revision. When properly installed equipment meets Low Voltage, Class 2 classification of the NEC.

3.03 NAMING CONVENTIONS

A. Weather proof labels showing the corresponding camera number shall be applied to each camera’s housing.

3.04 TESTING

A. The VSS system shall be tested in accordance with the following:

1. Conduct a complete inspection and test of all installed access control and security monitoring equipment. This includes testing and verifying connection to equipment of other divisions such as intrusion detection and access control systems.

2. Provide staff to test all devices and all operational features of the Security Management System for witness by the Owner’s representative and authorities having jurisdiction as applicable.

3. Correct deficiencies until satisfactory results are obtained.

B. Submit written copies of test results.
Complete Checklist for Security VSS provided in Appendix A.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 OWNER ORIENTATION (TRAINING)

A. Before contract closeout provide the following training and orientation:

1. Provide a minimum 48 hours training for facility designated representatives. The content of the training is advanced instruction on the use, programming, maintenance and troubleshooting of the video surveillance system, devices and components.

a. Materials shall include training manuals and hands-on lab exercises.

b. The training shall be provided at the equipment manufacturer's authorized training facility located in Los Angeles County.

c. Training shall consist of classroom instruction including intensive course work covering the following topics:

1) Product Features and Technical Specifications

2) Implementation and Design as–built documentation, including familiarization with drawing sets, symbols and notation as well as other record documents.

3) Complete understanding of the system architecture and design of implemented solution.

4) Complete function and feature analysis on implemented solution including programming, operation, trouble shooting, error messages, etc.

3.07 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire alarm system shall consist of fire alarm control panel or networked nodes of the same make and be CSFM (California State Fire Marshall) listed for the application.
2. Labor, equipment, materials, connections, testing, and performance of operations in the installation of fire alarm system.

B. Related Requirements:

1. Division 01 General Requirements.
2. Section 14 24 23: Hydraulic Passenger Elevators.
3. Section 21 13 13: Fire Suppression Sprinkler Systems.
4. Section 23 80 00: Mechanical Equipment.
5. Section 26 05 00: Common Work Results for Electrical.
6. Section 26 05 13: Basic Electrical Materials and Methods.
7. Section 26 05 19: Low-Voltage Wire (600 Volt AC).
8. Section 26 05 26: Grounding and Bonding.
9. Section 26 05 33: Raceways, Boxes, Fittings, and Supports.
10. Section 27 53 13: Clock and Program Systems.
11. Section 27 51 16: Public Address and Intercommunication Systems.
12. Section 27 5129: Public Address Systems

1.02 SYSTEM REQUIREMENTS

A. Fire detection system shall continually supervise and monitor the following initiating, signaling, and monitoring circuits:

1. Manual fire-pull stations.
2. Smoke and heat detectors, duct detectors, multicriteria detectors, combination smoke/heat/CO Detectors, including detectors installed under other sections.
3. Fire sprinkler flow and tamper switches. In existing installations also include PIV tamper switches.
4. Alarm signaling circuits including alarm bells, horns and visual alarm units.
5. Annunciators.
6. Power supplies and batteries.
7. Interconnection with Central and Autonomous Public Address systems, telephone network system, Clock System-Classroom or Program schedule change, HVAC system where applicable, kitchen fire suppression system, Theatrical and House Lighting, elevator equipment for control of recall function and elevator circuit breaker shunt trip, and other systems required by code.

B. System controls shall be UL listed for power limited applications in accordance with California Electrical Code.

C. System shall be listed for Internet of Things (IoT) security in compliance with UL 2900.

D. The fire alarm devices and equipment shall be listed for installation for the fire alarm control panel to which they are being connected.

E. Complete installation shall conform to the version of NFPA 72, California Fire Code, California Building Code (CBC), and California Electrical Code (CEC) as approved by DSA on stamped drawings.

F. System labels and devices programming addresses shall be based on final signage and building labeling submittals. For existing facilities contractor shall obtain from Owner Authorized Representative a copy of the current site layout and building labeling designations.

1.03 CERTIFICATION

A. Certification: Installation of fire alarm system shall not begin until Shop Drawings, including State Fire Marshal listing numbers of fire alarm components, are submitted and reviewed by the Architect. Written certification by fire alarm equipment distributor or manufacturer shall be submitted to the Architect stating that system and its component parts are as approved and listed by the State Fire Marshal, and that the design conforms to requirements set forth in CBC.

1.04 PERFORMANCE

A. System shall be fully programmable, configurable, and expandable in the field without special tools or PROM programmers and shall not require replacement of memory ICs. Installer shall provide a CD of system installed software, site specific system programming and information and tools required to re-program or modify the system.

1.05 SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected by one of the system alarm initiating devices, the following functions shall occur:

1. System alarm LED shall flash.
2. Local sounding device in panel shall be activated.
3. The LCD display shall indicate type of device, custom label location label and point status alarm condition.
4. Appropriate change of status message shall be transmitted to remote annunciator(s).
5. Automatic programs assigned to alarm point shall be executed and associated indicating devices and relays activated.
6. In the event of a fire alarm control panel activation, manual and automatic electronic tone or electromechanical bell class passing signals shall be disabled.
7. In the event of a fire alarm condition the Central and Autonomous Public Address System shall be overridden.
8. UDACT (Universal Digital Alarm Communicator Transmitter) shall activate.
9. Provide necessary hardware and labor for a complete and tested interfacing of the fire alarm system with the lighting controls systems in Auditoriums, Multi-Purpose

rooms, and Gymnasiums; lighting in these areas shall be brought to full brightness in the event of a fire alarm.

B. Trouble and Supervisory Conditions.

1. When any trouble condition is detected the following functions shall occur:

a. System trouble LED shall flash.

b. Local sounding device in panel shall be activated.

c. The LCD display shall indicate the type of trouble and custom label location associated with the trouble condition and its location. Unacknowledged alarm messages shall have priority over trouble messages. If such an alarm is displayed, then trouble messages shall not be displayed.

d. Appropriate message shall be transmitted to remote annunciators.

e. UDACT shall activate.

C. When any supervisory condition occurs such as a sprinkler valve tamper, the following function shall occur:

1. System supervisory LED shall flash.

2. Local sounding device in panel shall be activated.

3. Appropriate message shall be transmitted to remote annunciators.

4. UDACT shall activate.

D. Activation of control panel ACKNOWLEDGE switch in response to a single new alarm, trouble or supervisory condition shall silence panel sounding device and change system alarm, trouble, or supervisory LED from flashing to steady-ON. If additional new alarm, trouble, or supervisory conditions exist in the system; activation of this switch shall advance display to next alarm, trouble, or supervisory condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm, trouble, or supervisory condition shall cause panel to resound, and sequences as described above, shall repeat.

E. Activation of the signal silence switch shall cause appropriate notification (indicating) appliances and relays to return to normal condition. Selection of notification appliance circuits and relays silenced by this switch shall be fully programmable.

F. Activation of system reset switch shall cause electronically latched initiating devices or zones, as well as associated output devices and circuits, to return to normal condition after sixty seconds of alarm. If alarm conditions exist in system after system reset switch activation, system shall then re-sound alarm conditions as indicated hereafter.

G. Activation of lamp test switch shall turn on LED indicators, LCD display, and local sounding device in panel, and then return to previous condition.

H. Fire alarm indicating appliances may be silenced or extinguished, after one minute, by operating signal silence switch at the FACP or by use of key supervised alarm silence switch at remote annunciators. A subsequent zone alarm shall reactivate signals. Audible indicating appliances shall be automatically silenced after no less than five nor more than ten minutes of operation. Visual indicating appliances shall be extinguished at system reset, or automatically after no less than five nor more than ten minutes of operation. Fire sprinkler flow alarm bells shall not silence until the contacts in the fire sprinkler flow switch return to the normal non-alarm state. Appropriate signage must be installed on or next to the sprinkler alarm bell.

I. Elevator lobby, machine room and hoistway smoke detectors shall, in addition to operations listed above, cause elevator cars to be recalled as follows:

1. Elevator cars shall be recalled to main level of egress through the use of a primary recall interface relay.

2. Elevator cars shall be recalled to predetermine alternate level if main lobby smoke detector is activated.

3. Fire Fighter's hat light indicator in elevators shall provide visual warning when elevator lobby, machine room, and hoistway smoke detectors are activated.

J. System's circuits including but not limited to initiation, indicating, and equipment interfacing shall be monitored for open or short circuit and ground fault conditions, these conditions shall be indicated on the Fire Alarm Control Panel and Annunciator displays while remaining circuits continue to operate normally.

K. Notification appliance circuits shall be silenceable for testing purposes by authorized persons. Protected pass-codes, keys, or another secure method that does not require entering into the system programming shall be used.

1.06 POWER REQUIREMENTS

A. The fire alarm control panel and remote power supply shall receive 120 VAC power, 60 Hz, through a dedicated 20 amps circuit. Circuit breaker protection for the dedicated fire alarm power circuits shall be equipped with a handle lock-on device; the breaker handle shall be colored red and labeled "FIRE ALARM". Clearly label the Electrical panel name, location and circuit number on the inside of the fire alarm control panel and remote power supplies using a p-touch style labeling system. Transient voltage surge suppression shall be provided at the 120VAC input terminal.

B. System shall be provided with sufficient battery capacity to operate entire system upon loss of normal 120 VAC power, in a normal quiescent mode, for a period of 24 hours with five minutes of alarm indication at end of this period. System shall automatically transfer to standby batteries upon power failure. Battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70 percent capacity in 12 hours.

C. Circuits requiring system operating power shall be 24 VDC and shall be individually protected at control panel.

1.07 SUBMITTALS

A. Provide in accordance with Division 01.

B. Component Plan Submittal: Availability and listing for its application shall be verified for system components before presentation of the submittal. Include the following information and details as applicable:

1. Installer name, address, telephone number.

2. List of system components, equipment and devices, including manufacturer model numbers, quantity and California State Fire Marshal listing numbers, mounting heights, and symbols per symbol list.

3. Copies of manufacturer specification sheets for equipment and devices indicated. Highlight or identify the specific components on Catalog cut sheets.

4. Voltage Drop Calculations: Include the following information for the worst case:

a. Point-to-point or Ohms law calculations.

b. Zone used in calculations.

c. Voltage drop percent. Voltage drop shall not exceed manufacturer's requirements. If voltage drop exceeds ten percent, indicate manufacturer listed operating voltage ranges for equipment and devices.

5. Battery types, amp hours, and load calculations including the following:

a. Normal operation: 100 percent of applicable devices for 24 hours to equal control panel amps plus list of amps per device that draw power form the panel during standby power condition including, but not limited to, zone modules, detectors and devices as identified.

b. Alarm condition: 100 percent of applicable devices for five minutes to equal control panel amps plus list of amps per device that draw power from panel during alarm condition including, but not limited to, the following:

1) Zone modules.

2) Signal modules.

3) Detectors.

4) Signal devises.

5) Annunciator.

6) Other devices as identified.

c. Normal operation plus alarm operation load calculation shall include total amp hours required and total amp hours provided.

6. Provide one copy of testing procedures.

C. Shop Drawings: Provide Shop Drawings, in the same size as the design Drawings, include the following:

1. Provide drawing scale, elevations of system enclosures, and actual layout of the Fire Alarm Control Panel, power supply, annunciator, and main system components.

2. Site Plan indicating PIV and related fire sprinkler system devices and equipment to be monitored or supervised; such as water flow valves, and main equipment such as control panels, power supplies, annunciators, and components such as outdoor wall-mounted horns, sprinkler bells, pull boxes, underground pull boxes , wiring routes on buildings exteriors and underground locations. In each conduit or raceway run indicate conduit sizes, and quantities and type of wires.

a. In existing facilities make a distinction between existing and new installation.

3. Complete battery calculations, and voltage drop calculation shall be included; these calculations shall be based on the devices maximum UL current rating.

4. One line drawing for the entire system network indicating system components and wiring. The one line diagram shall show but not be limited to panel to panel interconnections, conductors gage and quantity, conduit size and type (designation) and specific function.

5. System panel one-line drawings indicating the quantity and type (designation) of conductors entering and exiting the fire alarm terminal cabinet in each building (enclosure) for initiating, notification, or other command control functions required for complete system operation:

a. Individual floor or building plan view drawings indicating device locations including end of line resistors “EOLR” in accordance with the legend provided.

b. Individual point addresses for initiation and notification devices.

c. Device “typical” wiring diagrams. These drawings shall indicate specific termination details for peripheral equipment and interface devices.

6. Provide interfacing with equipment furnished by others including voltages, and other required coordination items. Refer to 3.01-B.

7. Each of the pictorial diagrams included shall appear identical to the products they are intended to depict, in order to speed installation of the system, and to enhance the accuracy of the installation Work. Typical wiring diagrams or catalog sheets are not permitted.

8. Background Drawings with device locations of DSA approved drawings are available in electronic format and may be obtained from the Owner Authorized Representative (OAR). Contractor is solely responsible for the accuracy and completeness of shop drawings. Buildings that are not part of the contract shall be clearly identified “NOT IN CONTRACT”. Shop Drawings shall be prepared in the latest version of AutoCAD with three – CD ROM electronic copies submitted along with full sized Shop Drawings.

9. Other installation and coordination drawings specifically related to this section shall be included as follows:

a. Size A (8 ½ by 11) and size B (11 by 17) shall be bound into the manual.

b. Larger drawings shall be folded and inserted into transparent envelopes and bound into the manual.

10. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.

11. Samples: Provide Samples of material and equipment as required by the Architect. If Samples are requested, they shall be submitted within ten days from date of request.

D. In addition to the above requirements, provide submittals to meet any additional requirements of DSA.

E. Submittal of Equivalent Systems:

1. In addition to the submittal requirements of this section, if an equivalent system listed in Section 2.01A is submitted in lieu of the designed system shown on DSA approved drawings, the Contractor shall also submit a letter stating that the system is equivalent, and that device locations and quantities of devices are unchanged. Attached to this letter shall be a copy of the revised equipment schedule with corresponding CSFM numbers and a cut sheet for each item.

F. Modifications or additions to existing fire alarm systems shall be compatible and of the same manufacturer as the existing system. Contractor shall be solely responsible for engineering, plan check and any fees resulting from an installation that deviates from this requirement.

G. Prior to Substantial Completion submit to the Architect or Engineer of Record and to Owner Authorized Representative a complete updated set of the Shop Drawings showing changes made to the Fire Alarm System during construction. These drawings will become the System As-Built Drawing set for the Fire Alarm System Owner’s Manual.

1.08 QUALITY ASSURANCE

A. Installer shall have successfully completed at least five projects of equal scope in the past five years, and have been in business of furnishing and installing fire alarm systems of this type for at least five years.

B. Installer shall be a factory authorized distributor and service provider for the brand of equipment offered and shall provide documentation to the Architect upon request.

C. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain a spare set of major parts for the system at all times.

D. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.

E. Certifications: Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and is trained on network applications.

F. Materials and equipment installed shall be new.

G. Equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. Furnish a letter from the manufacturer of major equipment, which certifies that the installer is an authorized distributor and that the equipment has been installed according to factory intended practices. Furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

H. Installer shall be Underwriters Laboratory (UL) listed company under the UUJS classification, and shall certify that the installation has been made in accordance with UL requirements.

I. The fire alarm contractor shall have a NICET II Certified Technician on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.

J. Contractor or Installer's Electricians and fire and life safety technicians shall be certified in accordance with Labor Code sections 3099, and 3099.2, and section 209.0 of the California Code of Regulations.

K. System startup and testing shall be performed under the direct observation of the Project Inspector and OAR. Provide a legible half size reproduction of the original completed fire alarm red-line drawings (this copy will be retained by the Owner), an accurate copy of the fire alarm system points list, and a copy of the construction drawings on CD in AutoCad format.

L. At the time of installation the most current software package available shall be provided.

M. Provide at the time of Owner Acceptance of the installation, equipment, and updated software which is to include the appropriate operating system, pass-codes, electronic keys and program disks, manuals and cables employed in the installation of the system. These components shall be delivered to the OAR.

N. Provide a backup copy of the most current software revision, in disk format. This copy shall be delivered to the OAR

O. A software license agreement shall be made available for the responsible Owner representative to sign at the time of training.

1.09 WARRANTY

A. The Fire Alarm Equipment Manufacturer shall provide a three year material warranty. Installer shall provide a three year labor warranty.

B. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer for a period of five years after expiration of the warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fire alarm equipment shall be standard products of the Simplex.

B. Catalog and model numbers listed are intended to establish type and quality of equipment and system design as well as operating features required. Deviations from intended functions of specified system are not permitted. Equipment shall not be ordered or installed until such equipment has been reviewed and approved by the Architect.

C. Products requirements indicated in articles 2.02 through 2.05 are based on Simplex system components. Refer to Attachment A – Fire Alarm Approved System Components for a complete list of approved products.

2.02 FIRE ALARM CONTROL PANEL (FACP) OR NETWORK NODES

A. Furnish Fire Alarm Control Panels as indicated on drawings.

B. Operator Control:

1. Acknowledge Switch: Activation of control panel acknowledge switch in response to a single new trouble or alarm condition shall silence panel sounding device and change system alarm or trouble LED from flashing to steady-ON. If additional new alarm or trouble conditions exist in system, activation of this switch shall advance display to next alarm or trouble condition that exists, and shall not silence local audible device or change LED to steady until new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm or trouble condition shall cause panel to resound, and sequences as described above, shall repeat.

2. Signal (Alarm) Silence Switch: Activation of the signal silence switch shall cause programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully fielded programmable within the confines of applicable standards at the job site. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch: Alarm activate switch shall activate notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch: Activation of the System Reset switch shall cause electronically-latched initiating devices, appliances or software zone, as well as associated output devices and circuits, to return to their normal condition.

5. Lamp Test Switch: Switch shall activate local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personnel.

6. Hot Button Switch: Hot Button Key switch shall be provided in FACP to disable all output devices for testing or repair of system. Key switch shall silence all horn and

strobes, disable PA cutouts, HVAC shutdowns, door closures, and Autonomous PA systems. Key switch shall be password protected to enable function. LED indicator shall illuminate a trouble condition while Hot Button Switch is activated and shall turn off when system is re-enabled.

C. System Capacity and General Operation

1. The control panel or each network node shall provide or be capable of expansion to 636 minimum intelligent addressable devices in smaller systems, and 3180 intelligent addressable devices for larger systems.

2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of two amps at 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notifications Appliance Circuits.

3. The control panel or each network node shall support up to eight output modules (signal or relay), each with eight circuits for a total of 64 circuits for the smaller capacity panels, and 12 output modules for a total of 96 circuits for the larger capacity panels. Programmable notification appliance circuits shall be class B.

4. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.

5. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

6. The system shall allow the programming of any input to activate any output or group of outputs. The FACP shall support up to 20 logic equations, including “and” “or” and “not”, or timed delay equations to be used for advanced programming. Logic equations shall require the use of a PC with software utility designed for programming.

7. The FACP or each network node shall provide the following features:

   a. Drift compensation to extend detector accuracy over life. Drift Compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

   b. Detector Sensitivity tests, meeting requirements of NFPA 72 Chapter seven.

   c. Maintenance alert, with two levels (maintenance alert or maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

   d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advance detection laser detectors with an alarm level range of 0.03 percent per foot to one percent per foot. The system shall also include up to nine levels of Pre- alarm, selected by detector, to indicate impending alarms to maintenance personnel.

   e. Circuit boards, programming, and interconnecting cables to enable the system to display or print system reports.

   f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

g. PAS pre-signal testing in accordance with California Fire Code (CFC) and NFPA 72 requirements.

h. Rapid manual station reporting (less than three seconds) shall meet CFC and NFPA 72 requirements for activation of notification circuits within ten Seconds of initiating device activation.

i. Periodic detector test, conducted automatically by the software.

j. Self-optimizing pre-alarm for advance fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.

k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

l. Walk test, with a check for two detectors set to same address.

m. Control-by-time for non-fire operations, with holiday schedules.

n. Day or night automatic adjustment of detector sensitivity.

o. RS 232 serial port to support a District supplied printer to be used for silent testing and certification of the system.

8. The FACP shall be capable of coding main panel(s) node notification circuits in temporal code (NFPA 72 A-2-2.2.2).The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific “sync pulse”.

9. Network Communication:

a. The network architecture shall be based on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol. The protocol shall be based on ARCNET or equivalent non-proprietary protocol.

b. Failure of any node shall not cause failure or communication degradation of any other node or change the network communication protocol among surviving nodes located within distance limitations. A node may be an intelligent Fire Alarm Control Panel (FACP), Network Control Station PC (NCS) or Network Control Annunciator (NCA).

c. Each network node address shall be capable of storing Event Equations which shall be used to activate outputs on one network node from inputs on other network nodes.

D. System Display:

1. Utilize the 640-character display option. The design of the CPU shall provide for a configuration with the 640-character display mounted on the front of the unit in place of the standard 80-character display.

2. The 640-character display shall provide the controls and indicators used by the system operator: The 640 character display shall include the following operator control switches; Acknowledge, Alarm, Silence, Alarm Activate (drill), System Reset and Lamp Test.

3. The display shall annunciate status information and custom alphanumeric labels for intelligent detector, addressable modules, internal panel circuits, and software zones.

4. The 640-character display shall provide ten Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC Power and Network Communication, Fire Alarm, Pre alarm Warning, Security Alarm, Supervisory Event, System Trouble, Alarm Silence, Disabled Points, CPU failure.

5. The 640-character display shall use ten “soft” keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. The programming utility shall be provided to the OAR who will forward it to the local maintenance area representative.

6. The system shall support the display of battery charging current and voltage on the LCD display.

E. Network Control Annunciator:

1. When a networked system is installed a network controlled annunciator (NCA) shall be provided to display system intelligent points. The NCA shall be capable of displaying information for all possible points on the network.

2. The NCA shall include a minimum of 640 characters, backlit by a long life, solid-state LCD display. Additionally, the network display shall include ten soft keys for screen navigation and the ability to scroll events by type. i.e. Fire Alarm, Supervisory Alarm, Trouble, etc.

3. The NCA shall have the ability to display up to eight events in order of priority and time of occurrence. Counters shall be provided to indicate the total number of event by type.

4. The NCA shall mount in a Simplex ABS-2DB or equal keyed box; provide a key enable or disable switch for the network node fire alarm control panels. The network display may mount in a backbox designed for this use. The network shall support the NCAs.

5. The network control annunciator shall have an event history buffer capable of storing a minimum of 1000 events in nonvolatile memory. Additionally, the NCA shall have a fire alarm history buffer capable of storing a minimum of 200 events in nonvolatile memory.

6. The NCA shall include two EIA-232 ports for UL864 listed printers and CRT’s.

7. The NCA shall include control switches for system wide control of Acknowledge, Signal Silence, System Reset, Drill, and local Lamp Test. A mechanical means, by which the controls switches are locked out, such as a key, shall be provided.

8. The NCA shall include long life LEDs to display Power, Fire Alarm, Pre-Alarm, Security Alarm, System Trouble, Supervisory, Signals, Silenced, Disabled Prints, other (non-fire) Events, and CPU Failure.

9. The NCA shall include a Master Password and up to nine user Passwords. The Master password shall be required to access the programming and alter status menus. Each User password may have different levels of authorization assigned by the Master password. Passwords installed into the NCA shall be made available to the OAR who will forward them to the local maintenance area representative.

10. The NCA shall allow editing of label for points within the network, control on or off of outputs, enable or disable of network points, alter detector sensitivity, clear detector verification counters for any analog addressable detector within the network, clear any history log within the network, change the Time or Date settings, initiate a Walk Test.

11. The NCA shall include a time of day clock.

12. Each NCA shall support 80-character remote display annunciators for displaying network activity. These “Terminal Mode” displays will mimic the activity appearing on the corresponding NCA. There shall be only one annunciator or control system consisting of components manufactured by one manufacturer for the fire alarm system.

F. Signaling Line Circuits (SLC):

1. Each FACP or FACP network node shall support a minimum of one SLC for the smaller panels and ten SLC’s for the larger panels. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices.

2. CPU shall receive analog information from intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector’s desired sensitivity level by adjusting for the effects of environmental factors including the accumulation of dust in each detector. The analog information shall also be used for automatic detectors testing and for the automatic determination of detector maintenance requirements.

G. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer’s standard finish.

2. The back box and door shall be constructed of 0.030 steel with provisions for electrical conduit connections into the sides and top.

3. The supplied door shall include a key lock and shall include glass or other transparent opening for viewing of indicators. For convenience, the door may be site configured for either right or left hand hinging.

H. Power Supply:

1. An off-line switching power supply shall be available for the fire alarm control panel or network nodes.

2. Provisions shall be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

3. Over-current protection shall be provided on power outputs. The power supply shall provide an integral battery charger. Battery arrangement may be configured in the field.

4. The power supply shall continuously monitor field wires for earth ground conditions, and shall have the following LED indicators:

   a. Ground Fault LED.

   b. AC Power Fail LED.

   c. NCA-2 on LED (4).

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide power for the FACP or network node(s).

6. The main power supply shall provide a battery charger using dual rate charging technology for fast battery recharge and be capable of charging batteries up to 60 AH for the smaller panels and 200 AH for larger panels.

2.03 REMOTE ANNUNCIATORS

A. A non-networked fire alarm system annunciator is required when there is only one FACP in the system. Provide alphanumeric display remote annunciator(s) per plans. A Network annunciator is required for any system that contains more than one fire alarm control panel (FACP) or network node. Display shall be back lit and be furnished with a maximum of 20 characters of 4 lines for the smaller panels, and 40 characters on 16 lines for the larger panels. Annunciators shall provide the following functions:

1. Control switches for system acknowledge, signal silence and system reset via a touchpad.
2. Time and date display field.
3. Local piezo sounder with alarm or trouble resound.
4. On-line green LED (flashing).
5. Evacuation and drill switches, via a touchpad.
6. Pre-signal hold via a touchpad.
7. System test at control panel and CTR.

B. Following additional features shall be furnished:

1. Device Fire Annunciation.
2. Device Trouble Annunciation.
3. System Operation Annunciation.
4. "Power On" LED.

C. Typewritten operating instructions and a site map shall be posted adjacent to remote annunciator(s). The site map shall be sized and include designations and devices as described in paragraph 3.02 N. of this specification. Project site map shall depict fire alarm devices in the building(s) in which they are installed. The instruction and site map shall be mounted in suitable document frames and attached to the wall with a minimum of two screws each. Contractor’s name and telephone number shall not be placed on either the instruction or the site map.

2.04 POWER SUPPLIES

A. Remote Notification Appliance Circuit (NAC) extender power supplies shall be furnished with main printed circuit board, transformers, lockable cabinet, and batteries. Unit shall be configured to drive 4 notification appliance circuits. The remote power supplies shall be configured with a monitor module to report trouble conditions to the controlling FACP via an SLC. Triggering of NAC inputs shall be directly controlled from the FACP without the use of addressable control or relay modules.

2.05 PERIPHERAL DEVICES AND EQUIPMENT

A. Manual Stations (interior): Manual pull stations shall be addressable semi-flush, non-breakable glass type for building interiors. Station housing shall be fabricated of die-cast aluminum with reset lock and key. Provide an addressable monitor module for each manual station.

B. Manual Stations (exterior): Manual stations shall be addressable semi-flush, non-breakable glass type for building exteriors. Station housing shall be fabricated of die-cast aluminum with reset lock and key. Provide an addressable monitor module for each manual station.

C. Smoke Detectors: Smoke Detectors shall be addressable. Detector shall be microprocessor based, using a combination of photoelectric, and thermal sensing technologies. The smoke detector shall have its loop number and electronic address permanently and clearly labeled onto the device base using a p-touch type labeling system. The label shall be visible without re moving the detector head.

D. Non-Explosion Proof Automatic Addressable Heat Detectors shall be combination rate-of-rise and fixed-temperature type. When fixed-temperature portion is activated, units shall provide visual evidence of such operation (LED). The location of the heat detector must be clearly marked below the ceiling and the detector must be readily accessible. The heat detector shall have its electronic address permanently and clearly labeled onto the device and be readily accessible. For spaces such as attics, where the ambient temperature can reach around 150^{o} degrees Fahrenheit in hot days, use detectors rated for the application. The heat detector shall have its loop number and electronic address permanently and clearly labeled onto the device using a p-touch labeling system. The label shall be visible without removing the detector head.

E. Explosion Proof Automatic Heat Detectors shall be rated for 135^{o} degree Fahrenheit alarm temperature. Mount the detector on a JL threaded hub cover manufactured by Killark Electric, or equivalent from other owner approved manufacturers. Seals, conduit type, and fittings shall be suitable for the hazardous zone and location where the device will be installed. Provide an appropriate wire protective cover over box and detector. Addressable module(s) associated with this type of devices shall be installed outside of the hazardous area.

F. Weatherproof Automatic heat Detectors: shall be rated for 135^{o} degree Fahrenheit alarm temperature. Detector shall be mounted horizontally in a two gang weatherproof box with cover manufactured by Hubbell/Bell or equivalent from other owner approved manufactures. Install an appropriate wire protective cover over box and detector. Conduit type and fittings shall be suitable for the environment where the device will be installed.

G. Duct Smoke Detectors: Duct smoke detectors shall be of solid-state photoelectric type and shall operate on light-scattering photodiode principle. The location of the duct detector must be clearly marked below the ceiling and the detector must be readily accessible. The duct smoke detector shall have its electronic address permanently and clearly labeled onto the device. The label shall be visible without removing the detector head. Duct smoke detectors that are already installed as part of packaged ventilation equipment that are not the detector specified above shall be connected to the fire alarm system via a monitor module. The existing power source shall be disconnected and resettable power from the FACP or Remote Power Supply shall be connected in place of the existing power source for fire alarm system resettable power and alarm initiation.

H. Projected Beam Infrared Type Smoke Detectors shall consist of a transmitter/ receiver unit and reflector to be used in accordance with manufacturer's recommendations. Each detector shall include six user-selectable sensitivity levels. Alignment shall be achieved with a signal strength meter incorporated into the beam detector. The detector shall feature automatic detection and adjustment to the optimum level for the specific environment. Provide remote System Sensor Model RTS-451KEY test stations with key lock for detectors or equal, locate test stations below ceiling.

I. Linear Heat Detectors: Linear detectors shall be Protectowire or equal. linear detectors shall be rated for 150-degree Fahrenheit installed ambient temperature and 190-degree Fahrenheit alarm temperature. Damaged detector due to excessive bending or kinking

during installation shall not be accepted. Interface the Protectowire detector with the FACP system via addressable monitor module(s) located on one extreme of the detector and an end of line resistor at the other extreme. End of line resistor shall be readily accessible for testing. Provide appropriate signs indicating the existence of linear heat detectors at the entrances of areas protected with this type of fire detection. Installation shall be done in accordance with applicable codes and standards, and manufacturer's published installation recommendations.

1. Provide a system that utilizes linear heat detectors in concealed or controlled access areas. The detection wire shall be installed within 20 inches of the underside of the building roof or the above floor as recommended by the manufacturer. In shallow areas install the detection wire within the upper part of the space to be protected.

    a. One circuit of linear heat detection shall be utilized for areas not exceeding 4,000 square feet above multiple rooms.

    b. Areas above Gymnasiums and Auditoriums exceeding 4,000 square feet shall be considered one zone.

    c. Areas divided by a fire rated wall shall be protected separately and considered an independent zone.

J. Multi-Criteria Fire Detectors (MS and HS Only): These Detectors shall be used on performing stages and surrounding areas of the performing stage and other locations where the use of special effect smoke systems may be used.

1. Multi-Criteria Fire Detector shall combine four separate sensing elements into one unit:

    a. Photoelectric chamber shall sense airborne particulate for smoke detection.

    b. Electrochemical cell technology shall monitor carbon monoxide.

    c. Infrared sensing shall measure ambient light levels and flame signatures.

    d. Thermal detection shall monitor temperature.

2. Multi-Criteria Detector shall be capable of generating only one alarm signal from at least two sensors of the four when positively confirming a fire. The sensor output shall be mathematically evaluated to determine when a signal is warranted.

3. Twin LED indicators shall provide 360 degree visibility.

K. Monitor Modules:

1. Monitor modules shall connect a supervised zone of conventional initiating devices, N.O. dry contact devices, including four-wire smoke detectors, to one of SLC loops. Monitor module shall install in a four-inch square by 2 1/8-inch deep electrical box. The module shall have its loop number, electronic address, and function label on the front cover using a P-Touch type or equal labeling system.

2. Monitor module shall provide address-setting means using rotary decimal switches and shall store an internal type of device. An LED shall be provided which shall flash under normal conditions indicating that monitor module is operational and in regular communication with control panel.

L. Control Modules:

1. Control modules shall be used to connect conventional indicating appliances or MR type isolation relays to one of the SLC loops. Control modules shall be installed in a standard four-inch square by 2 1/8-inch deep electrical box. Audio or visual or

relay power shall be provided by a separate loop from main control panel or from supervised remote power supplies. Each module shall have its loop number, electronic address, and function label on the front cover using a p-Touch type or equal labeling system. Provide Air Products PAM-3 Relay Model or equal power supervision relay to monitor 24-volt DC power.

2. Control module shall provide address-setting means using rotary decimal switches and shall store an internal identifying code which control panel shall use to identify type of device. An LED shall be provided which shall flash under normal conditions, indicating that control module is operational and in regular communication with control panel.

M. Relay Modules:

1. Relay Module shall be Simplex depending on requirements. Modules shall provide as a minimum one set of form “C” dry contacts and have its loop number, electronic address, and function labeled on the front cover using a P-Touch type labeling system.

2. Provide a buffer relay that is part of the control system if controlled circuit(s) exceeds the voltage or current rating of the relay module.

3. Relays used to interface control of other systems shall be electrically supervised and shall only be wired in a fail-safe mode of function during a power failure.

N. Isolator Modules:

1. Isolator module shall isolate wire-to-wire circuits on an SLC loop in order to limit number of other modules or detectors that are incapacitated by short circuit fault. If a wire-to-wire short occurs, isolator shall automatically open-circuit SLC loop. When short is corrected, isolators shall automatically reconnect isolated section of SLC loop.

2. Isolator module shall not require address setting, although isolators will electrically reduce capacity of loop by two detectors or module addresses. Isolator module will install in a standard 4-inch deep electrical box. It shall include a single LED that shall flash to indicate that isolator is operational and shall illuminate steadily to indicate that a short has been detected and isolated.

O. Speakers and Strobes: Speakers and strobes shall be products of the same manufacturer. In order to establish a standard of quality, items are specified from the products manufactured by System Sensor, acceptable manufacturers are Honeywell, Wheelock Inc., Gentex or District approved equal. Addressable or multifunction two wire indicating (Audible or Visual) appliances shall not be acceptable.

1. Alarm speakers shall be polarized and operated by 24 VDC. Entire unit shall be red finish. Speaker assemblies shall be furnished with separate wire leads for in or out wiring for legs of associated signal circuits. T tapping of signal device conductors to signal circuit conductors is not permitted. Suitable gaskets shall be provided for weatherproof installation. Speakers shall provide a minimum sound pressure level of 100 dB at 10 feet. Speakers shall be mounted on manufacturer’s recommended outlet boxes. Provide speakers with a back box skirt on indoor surface mount outlet boxes.

2. Speaker/strobe shall be wall mounted or ceiling mounted Simplex or equal. Speaker/strobe shall operate on two separate two wire 24 VDC polarized circuits and shall be provided with a semi-flush mounting plate. Entire unit shall be red finish. Strobe light shall have a clear Lexan lens. The word "FIRE" shall be printed on the two sides of the strobe body. Speaker shall provide a minimum sound output

of 100 dB at 10 feet. The strobe shall provide a selectable minimum light intensity of 15, 30, 60, 75, 90, 110, 135, 150, or 185 Candela as indicated on Drawings to meet or exceed requirements of CBC, CHAPTER 11B AND ADAAG and UL 1971. Speaker/Strobes shall be mounted on manufacturer recommended outlet boxes. Weather proof speaker shall be Simplex. Provide a model No. BBS-2 back box skirt on indoor surface mounted outlet boxes.

3. Strobe indicating appliances shall be System Sensor or equal. Devices shall be UL listed and shall be wall-mounted. Entire unit shall be red finish. Strobe light shall have a clear Lexan lens. The word "FIRE" shall be printed on two sides of the strobe body. Strobes shall meet CBC, CHAPTER 11B AND ADAAG and UL 1971 requirements. The strobe shall provide a selectable minimum light intensity of 15, 30, 60, 75, 90, 110, 135, 150, or 185 Candela as indicated on the Drawings to meet or exceed requirements of CBC, CHAPTER 11B AND ADAAG and UL 1971. Strobes shall be mounted on manufacturer recommended outlet boxes. Weather proof strobe shall be Simplex. Provide a model No. BBS-2 back box skirt on indoor outlet boxes.

4. Strobe synchronization modules if required shall be System Sensor or equal, to be installed in conjunction with two or more strobes located in same room or corridor or as indicated on Drawings. (Strobe synchronization modules must be compatible with installed strobes).

P. Electromagnetic Door Holder: Electromagnetic door holders shall be installed on doors as indicated on Drawings or as required. Electromagnetic Doors shall consist of a wall-mounted electromagnet and a door-mounted armature with an adjustable contact plate. Electromagnets shall provide a force of attraction of 35 pounds when energized and less than three pounds residual with power disconnected. Armature contact plates shall provide a horizontal adjustment of 25 degrees. The holding force of Electromagnetic Doors shall be totally electromagnetic and without the use of mechanical linkage or other moving parts. Electromagnetic Door Holders shall normally be energized, and a release shall be accomplished by interrupting the circuit. Door holders shall be Reliable Security Group DH Serie or Altronix. The power supply shall be equipped with a failsafe input trigger circuit and five individually protected outputs. (Electromagnetic Door holders shall not be powered by an FACP or remote NAC power supplies).

Q. Bells shall be Cooper Notification polarized type and operated by 24 VDC. Bell shall be powered from FACP or Remote NAC power supply. When used as a notification appliance to indicate fire sprinkler water flow the bell shall be directly controlled by contacts in the associated flow switch. Addressable relays or control modules shall not be used to supervise sprinkler bells. Bell assemblies shall provide separate wire leads for in or out wiring for legs of associated signal circuits. Bells shall be vibrating type providing a minimum sound pressure level output of 84 - 87 dB at ten feet. Bells shall be ten inches in diameter, finished with baked-on red enamel paint, UL listed for fire alarm installation, and suitable for surface or semi-flush mounting. Provide a sign adjacent to the water flow bell with one inch tall and 3/8 inch stroke white lettering on a bright red background. The sign shall read: “NOTIFY FIRE DEPARTMENT WHEN ALARM SOUNDS”.

R. Water-flow Switches:

1. Water-flow switches shall be Potter Electric or equal. Vane-type water-flow switches shall be installed on system piping as designated on Drawings or as required. Detectors shall install on clear pipe spans of appropriate nominal size, either a vertical or horizontal run, at least six inches from fittings or valves which may change water direction, flow rate or pipe diameter, and not closer than 24 inches to valves or drains. Detector shall respond to water-flow in specified direction after a preset time delay that is field adjustable. Actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and

connected by a mechanical linkage to delay mechanism. Output shall consist of ten amps (dual SPDT switches form-C contacts). A conduit entrance for standard electrical conduit fittings shall be provided on detectors. Detectors shall be listed by UL for indoor or outdoor installation. No more than 18 inches of seal-tight flex may be used to connect the water flow or tamper switch to the site conduit system at any one location.

2. Sprinkler valve tamper switches shall be System Sensor for use with outside screw-and-yoke valves or for use with post indicating valves or equal, as indicated. Supervisory switch shall be installed on valves as designated on Drawings or as required. Switches shall be installed to not interfere with normal valve operation and shall be adjusted to operate within two revolutions of valve control or when stem has moved no more than 1/5 of distance from its normal position. Mechanism shall be housed in a weatherproof die cast metal enclosure, also providing a 3/4 inch tapped conduit entrance to incorporate necessary facilities for attachment to valve. Switch mechanism shall be furnished with a minimum rated capacity of ten amps at 125 VAC and 2.5 amps at 24 VAC. Entire installed assembly shall be tamper-resistant. Tamper switches shall be UL listed. No more than 18 inches of seal-tight flex may be used to connect the water flow or tamper switch to the site conduit system at any one location.

S. Universal Digital Alarm Communicator Transmitter shall be Simplex.The UDACT is an interface for communication of digital information between a fire alarm control panel and a UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL or NFPA or FCC requirements. It shall include the ability for split reporting of panel events between up to three different telephone numbers.

3. It shall be completely field programmable from a built in keypad or laptop computer, and shall be capable of transmitting events in multiple formats.

4. Communication shall include vital system status such as:

   a. Independent Zone (Alarm, trouble, non-alarm, supervisory.

   b. Independent Addressable Device Status.

   c. AC (Mains) and Earth Fault.

   d. System Off Normal.

   e. 12 and 24 Hour Test Signal.

   f. Abnormal Test Signal (per UL requirements).

   g. EIA-485 Communications Failure.

   h. Phone Line Failure.

5. The UDACT shall support independent zone or point reporting when used in the Contact ID format. This enables the central station to have exact details concerning the origin of the fire or response emergency.

6. The UDACT shall be supplied with two eight conductor, two to six foot long line cords. One end of the cords shall plug into the jacks on the UDACT. The other end of the cords shall plug into industry standard RJ-31X surface mounted telephone jacks. Install jacks in a screw cover box adjacent to the FACP if sufficient space is not available within the FACP, or adjacent fire alarm terminal cabinet. The line cords shall be installed in conduit when it is necessary to locate the jacks remotely from the FACP enclosure. The jacks shall be mounted to the rear of the box. The telephone number for each line shall be labeled on its respective jack.

T. Voice Evacuation System:

1. The Voice Evacuation Control (EVAC) Panel. The self-contained control panel shall be equipped with dual 25-watt audio amplifiers each with a single style Y (Class B) supervised 25 Vrms output circuit. The EVAC panel shall have the ability to record a minimum of two field-programmable messages of up to 60 seconds total duration with an integral microphone or an external source via an audio input jack. The messages shall be stored digitally onto a non-volatile EEPROM. The message(s) shall be individually field programmable for three, four, six, eight, or indefinite repeat while triggered by the host FACP. Any message being delivered at the time of the trigger circuit(s) reset shall not stop in mid-sentence but shall be completed to the end of the message. A tone generator shall be provided capable of emulating a field programmable lead-in or trailing alert tone or an Audible Emergency Evacuation Signal (Temporal Pattern). The EVAC panel shall be capable of electrically supervising in both active and standby conditions, the amplifier outputs, field wiring, message generator, tone generator, microphone and primary or secondary power supplies to an internal trouble relay(s). The trouble relay(s) contacts shall be accessible via a terminal strip and be configured and connected to report internal or external trouble conditions to the host FACP via the trigger circuit or a separate monitor module. The minimum of two trigger circuits shall be individually field-configurable for triggering with a NAC circuit or a supervised dry contact. The control panel shall be equipped with LED indicator lights for Power On, System Trouble, Message Generator Trouble, Tone Generator Trouble, Microphone Trouble, Battery Trouble, Charger Trouble, Ground Fault, Output Circuit Trouble and Amplifier Supervisory. The panel shall be equipped with an internal monitor speaker for reviewing the field recorded messages. The primary power supply shall operate at 120 VAC through a dedicated 20 amp. circuit and shall be capable of charging 18 AH lead acid batteries. Provide two 12 volt batteries that will provide a secondary power source for the same or longer duration than is required by the host FACP. An auxiliary 24 volt DC power output shall be provided for use by an associated addressable control module. The EVAC control panel shall be triggered either directly by the associated FACP with a NAC circuit or by an addressable control module. Provide 3/8 inch minimum P Touch labeling on the window in front of the built in microphone indicating that “THE INTERNAL MICROPHONE IS TO BE USED FOR THE RECORDING OF ANNOUNCEMENTS ONLY. NOT FOR USE BY STAFF OR FIRE DEPARTMENT PERSONNEL.”

2. Ceiling Mounted eight-inch EVAC Speakers shall be mounted in a Simplex Model CBB-8 back box or equal. The speaker assembly shall be supplied with a white 12 inch round metal grill. The 8 inch speaker shall have an impedance of 8 ohms, minimum 9.5 ounce magnet and an attached 25 volt audio line matching transformer with 1/8, 1/4, 1/2, 1, 2, 4 and 8 watt tap settings and DC blocking capacitor. Wattage shall be selectable by the use of a jumper or shunt. Audio levels shall be 75, 78, 81 87, 90 or 93 dba at ten feet. Input or output terminals that will accommodate 12 to 18 AWG wire shall be provided. Speakers orientated in the same direction shall be connected in phase with each other. Multiple speakers

in areas such as Auditoriums or Gymnasiums shall be divided into two circuits in a checker board pattern and connected separately to the two audio output circuits.

3. Wall Mount four-inch EVAC Speakers shall be mounted on a manufacture recommended outlet box. When mounted on a surface mount outlet box, Provide a Model No. BBS-SP201R surface mount backbox skirt. The speaker assembly shall be supplied with a square high impact red grill. The four inch speaker shall have an attached 25 volt audio line matching transformer with 1/4, 1/2, 1 and 2 watt tap settings and a DC blocking capacitor. Wattage shall be selectable by the use of a jumper or shunt. Audio levels shall be 80, 84, 86 or 89 dba at ten feet. Input or Output terminals that will accommodate 12 to 18 AWG wire shall be provided. Speakers orientated in the same direction shall be connected in phase with each other; but when installed facing opposite directions they shall be connected out of phase.

U. Network Cables or SLC or Annunciator Data or Audio Output Cables: The construction and physical characteristics such as aqua-seal water block, wire gage, insulation and jacket types, etc. shall not be altered. Equivalent cables must be specifically approved and recommended by the manufacturer of the fire alarm system equipment. Substitutions will require review from the Architect or Engineer of Record.

V. The cable types listed below are based and specified on the recommendations of Simplex Fire Alarm Systems. If the submitted fire alarm system requires a different cable configuration with additional conductors, multi-conductor versus twisted pairs, etcetera, other than as is specified above, then request a substitution to supply and install the configuration of cables by the make and model of the fire alarm system that is to be installed.

1. Indoor Network and EVAC System Audio Output Circuit(s) applications shall be in conduit or in surface mounted raceway as indicated on drawings: West Penn No. D980, one pair 18 gage solid copper, unshielded, Copolene II insulated and PVC jacketed, or equal.

2. Indoor SLC applications in conduit or in surface mounted raceway where it is indicated on drawings: West Penn No. D990, one pair 16 gage solid copper, unshielded, Copolene II insulated and PVC jacketed, or equal.

3. Indoor Annunciator applications in conduit or in surface mounted raceway where it is indicated on drawings: West Penn No. D975, one pair 18 gage solid copper, shielded, Copolene II insulated and PVC jacketed, or equal.

4. Outdoor or Underground Network Applications: West Penn AQ224, two-conductor 18 gage stranded copper, unshielded, water-blocked construction and PVC insulated, or equal.

5. Outdoor or Underground SLC applications: West Penn AQ225, 2-conductor 16 gage, AQ226, 2 conductor 14 gage, or AQ227, 2 conductor 12 gage stranded copper, unshielded water-blocked construction and PVC insulated, or equal.

6. Outdoor or Underground Annunciator applications: West Penn AQ293, 2 conductors, 18 gage stranded copper, shielded water-blocked construction and PVC insulated, or equal.

W. Protective Covers

1. Provide protective covers for pull stations, smoke and heat detectors, and audible and visual devices located in areas occupied by students that can be subjected to vandalism such as gyms, restrooms, locker and shower rooms, and all hallways and corridors associated with these spaces. Installation of cover must not protrude over current ADA limitations.

PART 3 - EXECUTION

3.01 GENERAL

A. Fire alarm system shall not be used for any purpose other than fire alarm functions.

B. Fire alarm shall be interconnected but not limited to the following systems:

1. Systems required by code to be connected to the fire alarm systems shall be connected.
2. Public address system for disabling the manual and automatic bell or tone class passing signals. Manual and automatic class passing signals shall not be operable during alarm conditions.
3. Ventilation systems where required for the purpose of fan shutdown
4. Damper control or smoke management systems.
5. Water based fire sprinkler systems.
6. Chemical fire extinguisher systems.
7. Central and Autonomous PA system(s).
8. Theatrical lighting control system.
9. Elevator controls for the purpose of elevator cab Phase 1 recall and shunt trip control, circuit supervision and shunt trip power supervision.
10. Fire pump controller for required signaling and trouble supervision.

C. Fire alarm system shall not be interconnected to any of the following:

1. Sump warning systems,
2. Carbon monoxide detection systems.
3. Methane gas detection systems.
4. Elevator car alarm bell circuit.
5. Other unrelated system.

3.02 SYSTEM INSTALLATION

A. Install required conductors to devices indicated on Drawings. Provide required conductor terminations to devices for a complete system to function as specified and indicated on Drawings. Refer to Section 26 0519: Low-Voltage Wire (600 Volt AC), for installation and color coding requirements.

B. Splices are not allowed in junction boxes. Terminations shall be in terminal cabinets or on equipment terminals.

C. Conductors shall be installed within conduits, boxes, and terminal cabinets in a totally enclosed installation. Furnish and install conductors required to connect incoming and outgoing circuits, including spare conductors, to terminal strips within terminal cabinets.

D. Wiring within equipment and terminal cabinets shall be installed to conform to contract documentation and NFPA 72 standards, and shall be terminated on terminal blocks having terminals for required connections. Wiring shall be cabled, laced, and securely fastened in place so that no weight is imposed on equipment or terminals.

E. Install required terminal blocks within terminal cabinets. Terminal blocks shall be installed on inside back of cabinets only, not on side. Incoming wiring shall be terminated on the left

side of terminal blocks; outgoing wiring shall be terminated on the right side of the terminal blocks.

F. Conductors shall be color-coded per specification section 26 0519 Low Voltage wires and tagged with code markers at terminal cabinets, and equipment. A wire index shall be typed and installed on terminal cabinet doors. Index shall be covered with clear plastic adhesive covers. Wiring shall be identified as to building and location of devices in the index.

G. Wiring within equipment and terminal cabinets shall be carefully strapped, and shall be formed in rectangular configuration. Wires shall be properly numbered in numerical order and shall maintain same number throughout the Project site.

H. Complete installation shall comply with local building codes and applicable provisions of the California Electrical Code, California Fire Code and the NFPA 72 National Fire Alarm Code.

I. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Do not scale Drawings to determine locations and routing of conduits and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place, and must be ascertained in the field before the start of Work.

J. Drawings generally indicate Work to be provided, but do not indicate all bends, transitions or special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits are to be installed, and furnish and install required fittings.

K. Provide P-touch label of approximately one inch wide with red lettering for each initiating device that is hidden from view. Tags shall indicate the name and type of device: Heat Detector, or Duct Smoke Detector. Tags shall be permanently attached on access panel or t-bar grid which is used to access a hidden device.

L. Provide smoke and heat detectors in elevator hoist-ways if a fire sprinkler head is located at the top of the elevator hoist-way. Provisions shall be made for access to the detector without entering the elevator hoist-way. Access shall be provided through an approved enclosure with self-locking fire rated door. The detectors shall be so placed as to allow service to them without the service personnel having to reach into the hoist-way in the way of travel of the elevator car. Access to elevator hoist-ways and machine rooms (including escalators) must be supervised by the Owner's licensed elevator or escalator maintenance contractor. OAR is responsible for coordinating access in accordance with Contractor's schedule. Contractor shall provide a minimum of 48 hours' notice.

M. Provide adjacent to each annunciator a neatly typewritten copy of the Fire Alarm Operating Instructions. The instructions shall reflect the installed and programmed features of the system. Instructions that include information on non-installed or programmed features will not be acceptable. The instructions shall be placed into a suitably sized dark colored wood or metal frame with a glass document face cover. The frame shall be attached to the wall with a minimum of two screws into the wall material with appropriate anchors.

N. Provide adjacent to each annunciator a neatly drawn site map showing rooms with designations and buildings with names as programmed into the system. This map shall be sized to allow (normal vision) reading of the designations, names etc. A map so reduced in size to the point of not being readable will not be acceptable. This map shall include symbols indicating the locations of installed fire sprinkler flow switches, riser shut off valves, post indicating valves and manual pull stations. Provide a symbol list on the map for the symbols used. The site map shall be placed into a suitably sized dark colored wood or metal frame with a glass document face cover. The frame shall be attached to the wall with a minimum of two screws into the wall material with the appropriate anchors.

3.03 SYSTEM PROGRAMMING

A. Programming shall be performed in accordance with District requirements set forth in this section – the local authority having jurisdiction and applicable codes. If a conflict arises or a clarification is required, the contractor through the project's OAR shall contact the Districts Fire Life Systems Testing Group (FLSTG) for clarification

B. As part of the 50 percent construction completion label devices and locations in the manner indicted in the attached guidelines on a separate copy of the shop drawings. Request a meeting with OAR, Project Inspector, and representative of FLSTG to review, finalize and obtain approval of the proposed device, equipment and location descriptors that will be programmed into the system. The District may at time of substantial completion request minor changes to program descriptors if needed to conform to site conditions.

C. The following functions and features as required by the site or system configuration and installed peripheral equipment and systems shall be programmed into the campus fire alarm systems. The definition of programming shall include but not be limited to the use of a built in keyboard, the use of a connected PC with the appropriate software, dip or rotary switches, wiring or installable or removable jumpers as required or provided in the fire alarm equipment.

1. Signal Silence Switch Inhibit: The audible signal silence switch located on the remote fire alarm annunciator(s) or any fire alarm control panel(s) shall be programmed to not silence the audible or extinguish the visual alarm circuits during the first minute (60 seconds) of alarm activation. Activation of this switch shall silence only the audible signals. Enabling or disabling this feature shall be allowed only if approved by the local Fire Marshal and District's Supervising Electrical Engineer, and authorized District maintenance personnel. The activation feature shall be protected by a maintenance level password.

2. Fire Sprinkler Water Flow Audible Appliance: The fire sprinkler water flow appliance (bell) shall not require any programming but shall be directly controlled by a set of dry contacts within the associated sprinkler water flow switch(s). The 24 volt DC auxiliary power for the sprinkler water flow audible appliances shall be supplied by an FACP or a remote power supply. This audible appliance shall operate continuously during the detection of fire sprinkler water flow and shall not be coded in any manner nor silenced automatically by any FACP or manually by any user controls at any FACP or remote annunciator.

3. Fire Sprinkler Water Flow Switch: Fire sprinkler water flow switches shall be programmed in a manner that shall prevent the above Signal Silence Switch from silencing the audible coded signals or visual signals after the initiation of an alarm by a fire sprinkler flow switch.

4. Audible Notification Appliance Circuits: Audible notification appliance circuits shall be programmed to emulate the temporal code (ANSI S 3.41) from fire alarm audible appliances (horns). This coding shall originate and be controlled by a single coder residing within the FACP(s). The use of coders within remote power supplies either mounted adjacent to an FACP or at a remote location or directly by an audible notification appliance will not be permitted. Programmable audible notification appliances shall be configured to emulate a steady tone at approximately 1000 Hz. Audible notification appliance circuits shall be programmed to be silenced as described above. Notification appliance circuits throughout the site shall be activated by any alarm initiating device. Coded audible signals shall be controlled by a single synchronized FACP.

5. Visual Notification Appliance Circuits: Visual notification appliance circuits shall be programmed to provide steady non-coded power to the visual appliances (strobes). As required by code and the system configuration, a synchronization

signal shall be superimposed onto the NAC by the FACP, a remote power supply or an add-on synchronization module. Visual notification appliance circuits shall be programmed to be extinguished as described above. Visual notification appliance circuits throughout the site shall be activated by any alarm initiating device.

6. System Reset Button: The system reset button located on FACPs and remote annunciators in addition to resetting the fire alarm system and silencing or extinguishing notification appliances except for the sprinkler water flow appliances shall be programmed to reset analog and addressable smoke detectors, duct detectors, beam detectors and relays, addressable control modules and addressable relay modules used to interface to other systems and equipment. Each installed system reset button shall be programmed to operate as a “single point of reset” for the complete system.

7. HVAC Shutdown: Relays and addressable relay modules used to interface to HVAC equipment dampers, and supply and exhaust fan motors shall be programmed to shut down this equipment only within the same building where the detection of smoke, heat, carbon monoxide or fire sprinkler water flow has taken place. Manual pull stations within any building shall not affect the operation of the HVAC equipment. These relays shall return to normal only after the system is reset.

8. Elevator Recall: The addressable relay modules for the primary and alternate elevator recall function shall be programmed to activate only with the detection of smoke by a detector located in the elevator machine room, elevator hoistway or the main floor or alternate floor landing(s) smoke detector associated with that elevator or bank of elevators. Recall of an elevator shall be on a per-elevator or on a per-bank of elevators basis. Activation of other initiating devices shall not cause the recall of an elevator.

9. Fire Fighter Warning: In conjunction with the above elevator recall function, an additional addressable relay module shall be programmed to operate only with the detection of smoke by a detector located in an elevator machine room or elevator hoistway to provide a warning signal to fire fighters attempting to use the phase II elevator function.

10. Elevator Shunt Trip: The addressable control module or MR control relay for the elevator shunt trip shall only be activated by the heat detector located within the elevator machine room or elevator hoistway for each elevator or bank of elevators. Circuit integrity, and AC and DC power to the MR control relay shall be electrically supervised. Activation of other initiating devices shall not operate the shunt trip.

11. Smoke Detector Maintenance Alert: Addressable smoke detectors shall be programmed with the capability of initiating a maintenance alert when any one detector becomes obscured by dust or any other contaminates at approximately 10 percent below the level of obstruction that would initiate an alarm.

12. Disabling Class Passing Signals: The relay or addressable relay module shall be programmed to disable the class passing signals during any alarm condition at the site. This relay or addressable module shall return to normal only after the system is reset.

13. Disabling Audio of a Public Address System: The relay or addressable relay module shall be programmed to mute the audio output of the associated public address system during any activation of an audible notification appliance circuit or a voice evacuation announcement. This or these relays shall automatically restore to normal upon the silencing of the audible NACs and the voice evacuation announcement.

14. Release of Electro-Magnetically Held Doors: The relay or addressable relay module shall be programmed to open or close the control circuit as needed of the 24 volt DC door holder power supply. This relay(s) shall operate during any alarm condition within the same building as the door holders. The contacts shall return to normal only after system reset.

15. Illumination of House Lighting: The relay or addressable relay module shall be programmed to turn on to full brilliance the house lighting of an Auditorium, MP Room, etc. during any alarm condition at the site. This relay or addressable module shall return to normal only after the system is reset.

16. UDACT: The FACP and the associated Universal Digital Alarm Communication Transmitter shall be programmed to transmit to the central monitoring station separate indications for General Alarm, Fire Sprinkler Water Flow Alarm, System Trouble and Supervisory Conditions. These indications shall be in addition to any indications initiated by the UDACT itself.

17. Voice Evacuation Panel: The NAC originating at, or the addressable control module controlled by the associated FACP that is controlling the EVAC panel shall be programmed to emulate the above paragraph “E” Audible Notification Appliance Circuits except that it shall be non-coded. Trouble conditions at the EVAC panel shall report back to the associated FACP via the controlling NAC or addressable control module or a separate addressable monitor module. Transformer taps at the EVAC speakers shall be selected to provide the proper balance of audio volume in larger and smaller areas. The message shall be programmed in a female voice in the English language as follows: A minimum of two but no more than three cycle sounding of an approximate 1000 Hz tone in the pattern of the NFPA required temporal code followed by: “May I have your attention please. May I have your attention please”. The fire alarm has been activated in the building. The fire alarm has been activated in the building. Please proceed to the nearest exit and leave the building.” The sounding of the temporal patterned signal followed by the indicated message shall repeat indefinitely until the controlling NAC is reset.

18. Power Failure Reporting Time Delay: Main and remote NAC power supplies shall be programmed to delay the reporting of a site AC power failure for a minimum of 6 hours.

D. Device Descriptors:

1. Descriptors shall enable responding personnel to identify the location of a fire quickly and accurately, and shall indicate the status of emergency equipment or fire safety functions that might affect the safety of occupants. The minimum required information for devices intended to report smoke, fire, or fire sprinklers water flow include, but may not be limited to: Building, floor (if multiple floors exist in the building), room or space description, and device type and digital address (Smoke detector, Heat detector, Fire sprinkler water flow switch, etc.)

   a. Building: The building must always be included in the descriptor, even if there is only one building one the site. Additional building(s) may be added at a later date creating the possibility of confusion by similar designated spaces, such as “Work room” or “Staff restroom” if more than one building has these similar designated spaces. The building designation in the descriptor must be what the site-based personnel call the building. The building should be provided with signage to aid fire department personnel in the identification of the building.

   b. Floor: In multi-floor buildings the floor designation (1st, 2nd, etc.) must be included in the descriptor.

c. Room Description: The room or space description must be unique. Using the same designation for multiple spaces, such as "Workroom", "Counselor's Office", or "Men's restroom", etc. is not acceptable. If, during a project, the room numbers or the use of the room changes then the room or space descriptor must be changed to agree with the change. Proper signage should be provided for each space to aid fire department personnel in the identification of the room or space.

d. Device Type, Address and Compass Designations: The device type and digital address must be included with the descriptor, such as smoke detector or heat detector, etc. Some systems provide this information automatically in the descriptor. Compass designations, (N, S, E, and W) are required in spaces such as corridors where there are multiple detectors and this information would be helpful to responding fire department personnel in locating the device reporting alarm. It is not necessary to include compass designations in smaller spaces where there are multiple detectors located in close proximity to each other.

E. ACCEPTABLE ABBREVIATIONS

Rm.- Room	Bldg.- Building	Smk. - Smoke
Corr.- Corridor	Lby- Lobby	Asst. - Assistant
Eng.- English	N – North	Nrs. - Nurse
Flr.- Floor	S – South	Cnclr - Counselor
Ht.- Heat	E – East	Off. - Office
Lib.- Library	W – West	PE – Physical Education
Lkr. – Locker	Kit- Kitchen	RR- Rest Room
Stu Str – Student Store	Sci - Science	By = near
Stor Rm – Store Room	Café - Cafeteria	PM – Plant Manager
1st- First	2nd- Second	3rd- Third
Hopr Rm – Hopper Room	Det - Detector	Elev - Elevator
Prin – Principal	Blr Rm – Boiler Room	Conf – Conference
Park – Parking	Bsmt –Basement	MPR.- Multi-Purpose room

3.04 SYSTEM OPERATION

A. Unless otherwise specified, but not limited to actuation of manual stations, smoke detectors, heat detectors, linear heat or smoke detectors, or water-flow switches shall cause the following operations to occur, refer to Attachment B:

1. Activate audible circuits.

2. Actuate strobe units until the panel is reset or strobe circuit time-out.
3. Release magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.
4. Where required, return elevators to the primary or alternate floor of egress.
5. Smoke detectors in elevator lobbies shall, in addition to the above functions, return elevators to the primary or alternate floor of egress.
6. Smoke detectors in elevator machine rooms or tops of hoist-ways shall return elevators to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall perform this function in accordance with ANSI A 17.1 requirements and shall be coordinated.
7. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as required.
8. Activation of fire sprinkler system low-pressure switches, post indicator valve or tamper switches shall initiate a system supervisory alarm indication.
9. UL listed central station shall be notified via – Universal Digital Alarm Communicator Transmitter (UDACT).

3.05 TESTING

A. A 48 hour notice shall be provided to the Project Inspector before final testing.

B. Testing of fire detection system shall be as required by the State Fire Marshal and local authorities having jurisdiction. Installer is responsible for identifying required testing, coordinating, scheduling, and conducting tests before Substantial Completion. Tests shall include the following:

1. Operation of signal-initiating devices (smoke detectors, heat detectors, pull stations etc.).
2. Operation of indicating devices (alarm horns, alarm bells and alarm strobes).
3. Operation of system features under normal operation.
4. Operation of system supervisory features.
5. Operation of system features on standby power, with primary power turned off.
6. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
7. Close sprinkler system flow valves and verify proper supervisory alarm at the FACP.
8. Verify activation of flow switches.
9. Open initiating device circuits and verify that trouble signal actuates.
10. Open signaling line circuits and verify that trouble signal actuates.
11. Open and short notification appliance circuits and verify that trouble signal actuates.
12. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.
13. Ground initiating device circuits and verify response of trouble signals.
14. Ground signaling line circuit and verify response of trouble signals.

15. Ground notification appliance circuit and verify response of trouble signals.

16. Check alert tone to alarm notification devices.

17. Check installation, supervision, and operation of intelligent smoke detectors.

18. Alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

19. When the system is equipped with optional features, consult the manufacturer manual to determine proper testing procedures.

20. Theatrical lighting house light control override.

21. Central and Autonomous PA systems for muting during the sounding of the audible notification appliances and voice evacuation announcements.

22. Disabling electronic tone or electromechanical bell class passing signals until system reset.

C. Upon completion of installation of fire alarm equipment, provide to the OAR a signed, written statement confirming that fire alarm equipment was installed in accordance with the Specifications, Shop Drawings, instructions and directions provided by the manufacturer.

D. Demonstrate in presence of the Project Inspector that circuit and wiring tests are free of shorts and grounds and that installation performs as specified herein and within manufacturer's guidelines.

E. Software Modifications:

1. Provide the services of a factory trained and authorized technician to perform system software modification, upgrades or changes. Response time of the technician to the Project site shall not exceed 24 hours.

2. Provide hardware, software, programming tools, and documentation necessary to modify the fire alarm network on the Project site. Modification includes: addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modification on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being provided.

F. Complete the inspection and testing form as required by NFPA 72, and submit one copy of the completed form to the Architect and Project Inspector.

3.06 SERVICE MANUALS

A. Deliver to OAR, three copies of the service manuals. Each manual shall include the following:

1. Installation manuals, programming manuals and user manual if applicable for every control panel, control panel power supply, FACP input or output or relay or control module, auxiliary power supply, UDACT, remote NAC extender power supply, door holder power supplies, installed annunciators, initiating and indicating devices and addressable monitor, relay and control modules. Catalog cut sheets are not acceptable.

2. A printed copy of the system configuration as programmed, including system labeling codes, and passwords.

3. An electronic copy on compact disk of the system configuration program

4. Final test report.

5. Detailed explanation of the operation of the system.

6. Instructions for routine maintenance.

7. Detailed wiring diagram for the connection of relays, addressable monitor, and control or relay modules as applied in the interfacing of peripheral systems or equipment to the fire alarm system. Updated shop drawings shall include revisions made in the field via plan changes, RFIs, Field Change Directives, and any other construction change documents including interface details with ancillary systems.

8. An electronic copy (CD) of the posted site or fire alarm map in Auto-Cad and pdf formats.

9. Provide a CD ROM electronic copy of the updated system As-Built Drawings to the OAR, prepare this copy in the latest version of AutoCAD; along with the electronic copy provide a full size bond copy. Include one CD-ROM of the up-dated As-Built Drawings into each of the Service Manuals. CD and folded drawings shall be secured and inserted into the Service Manuals via a three-hole punched protective CD case and protective envelopes for the drawings.

10. Provide codes and passwords for fire alarm system at testing.

3.07 SPARE PARTS

The following new spare parts shall be furnished in unopened boxes:

1. Five percent spare pull stations including the associated monitor module (minimum one spare pull station per type).

2. Five percent spare smoke and heat detectors (minimum one spare smoke and heat detector per type).

3. Five percent spare audible devices (minimum one spare audible device per type).

4. Five percent spare strobe devices (minimum one spare strobe device per type).

3.08 SYSTEM USER AND MAINTENANCE PERSONNEL TRAINING

A. Before Substantial Completion, provide one instruction period for the Project site based Owner operators and system users. The instruction period shall be scheduled and coordinated by the OAR.

B. Training materials and required deliverables shall be submitted to the OAR.

1. Prior to beginning the operational demonstration, notify Central monitoring Station that an instructional activity is beginning; inform them that it includes setting and resetting the system in test mode. After the demonstration is completed and the system restored, notify the Central Monitoring Station that the system has been restored and it is back on line for continuous monitoring.

C. User Instruction and Training

1. Before substantial completion and with a fully functional fire alarm system installed at the site, the contractor shall provide a minimum of four hours of user training for site based staff. The date and time for this training shall be coordinated by the project OAR.

D. Instruction period training for site based staff shall consist of the following:

1. Overview:

a. Explain the fire system is “addressable” which means every device-smoke detector, heat detector, sprinkler water flow switch, manual pull station, etc. has a unique address or identity. This makes it possible to positively identify the exact device causing an alarm, trouble or supervisory condition.

b. Explain the fire alarm control panel also controls the horns and strobes throughout the campus or building.

c. Explain that the fire alarm system is interconnected to various other systems and equipment throughout the site such as:

1) Elevators to recall them to the main floor or to an alternate floor and as an option dependent circumstances turn off the power to the elevators.

2) Heating and air conditioning equipment to turn off fans and close dampers to stop the spread of smoke throughout a building.

3) The class passing signaling system to disable the bells or tones to not accidentally signal students and staff to return to the buildings.

4) Magnetically held doors to close them to stop the spread of smoke.

5) To turn up house lighting in an occupied Auditorium or Multi-Purpose room to provide adequate egress lighting.

6) The Central and Autonomous PA systems to mute them during the sounding of the alarm signal.

d. Explain the fire system has a battery backup in case of power failure and that it will continue to function for a minimum of 24 hours after a total power failure.

e. Explain that the fire alarm system components and wiring are monitored to report a malfunction, damage or vandalism. When this occurs, a trouble indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.

f. Explain that other equipment and systems are monitored for abnormal conditions such as the fire sprinkler water being turned off. When this occurs, a supervisory condition is created. A supervisory indication will appear on the fire alarm annunciator and FACP and this indication will be transmitted to the central monitoring station.

g. Explain that the fire system in addition to notifying the occupants of a possible fire condition also transmits an alarm indication to the central monitoring station that will in turn notify and dispatch the local fire department to your site.

2. Basic:

a. Hand out the SYSTEM OPERATION instructions to attendees.

b. Point out the Fire Alarm Control Panel and have them observe the normal LED status (one green LED only should be on):

1) GREEN = Normal.

2) YELLOW = Trouble.

3) RED = ALARM.

c. Have the attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

d. Point out the Fire Alarm System Annunciator and have attendees observe the LCD display that should be indicating a SYSTEM NORMAL message.

3. Operation and Demonstration:

a. After putting the system or having someone put the system central station monitoring into the test mode demonstrate the following:

b. Activate a Manual Pull Station to demonstrate ALARM.

1) Demonstrate audible and visual notification appliances and if installed the voice evacuation signal announcement.

2) Demonstrate panel or annunciator sounder tone for ALARM.

3) Have staff SILENCE system.

4) Show LCD display and LED of alarm.

5) Demonstrate and have staff reset the manual pull station.

6) Have staff RESET fire system.

c. Activate Smoke Detector with canned smoke to demonstrate address identification:

1) Have staff SILENCE system.

2) Show LCD and display LED of ALARM.

3) Have staff RESET fire system.

d. Remove Smoke Detector to demonstrate SYSTEM TROUBLE.

1) Demonstrate panel or annunciator sounder tone for TROUBLE.

2) Have staff SILENCE system.

3) Show LCD display and LED of TROUBLE.

4) Replace the smoke detector.

5) Have staff RESET fire system.

e. Remove power to demonstrate function during power failure.

1) Have staff SILENCE system.

2) Show LCD display and LED of TROUBLE.

3) Activate Manual Pull station to demonstrate audible or visual functions in power failure mode.

4) Reset manual pull station.

5) Reset fire system.

6) If applicable, point out sprinkler riser and shut off valves.

7) Show location of a water flow switch.

8) Show location of a valve tamper switch.

9) Point out valves must always be OPEN or fully counter clock wise.

10) Point out PIV (Post Indicator Valves) if applicable.

11) Have water flow through the inspectors test valve and point out the ringing water flow bell.

12) After the horns are silenced by an assistant, show that the water flow bell is ringing continuously indicating water flow.

13) Have the assistant turn off the inspectors test valve to show that water flow alarm bell turns off.

14) Reset system.

15) Unlock and turn off a PIV or riser valve to show a supervisory condition.

16) Turn valve back on, lock the valve open and demonstrate the end of the indication of a supervisory condition.

4. Training documentation.

a. Insure fire panel is reset and indicates normal and central station monitoring is taken off of the test mode.

b. Have staff attendees sign off training sheet and provide a copy to the PROJECT INSPECTOR.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materals and legally dispose of off Project site.

END OF SECTION

DIVISION 31
EARTHWORK

SECTION 311100 - SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Protection of existing trees indicated to remain.
2. Removal of trees and other vegetation.
3. Topsoil stripping.
4. Clearing and grubbing.
5. Removing above-grade improvements.

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct city streets, walks, or other occupied or used facilities without permission from owner or authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage t existing improvements indicated to remain in place.
1. Protect improvements on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to property owners. The full width of pavements damaged due to construction access and other construction-related activities shall be replaced with a structural section (pavement and base) at least equal to the adjacent existing section.
3. Protect all existing utility lines not scheduled for removal. Notify Owner immediately of any damage to or encounter with an unknown existing utility line. Immediately repair damage to existing utility lines.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
1. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.

D. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

1.4 EXISTING SERVICES

A. Contractor to determine exact locations of utilities before commencing Work. Contractor to protect all existing utilities within limit of construction work.

B. Where necessary, contractor shall coordinate relocation of irrigation pipe and appurtenant structures with owner

PART 2 – PRODUCTS

2.1 MATERIALS

A. Tree Wound Paint: Bituminous based paint of standard manufacture specially formulated for the intended use.

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
   1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new Construction.
   2. Unless specifically designated to remain, strip the upper two inches (minimum) of soil containing vegetation and root growth within the Limits of Work shown on the Drawings.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
   1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
      a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
   2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.
   3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.

C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
   1. Completely remove stumps, roots, and other debris protruding through ground surface.
   2. Use only hand methods for grubbing inside drip line of trees indicated to remain.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
    a) Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer and compact in accordance with the requirements specified in Section 312000 “Earthwork” to make the new surface conform with the existing adjacent surface of the ground.
4. Trim trees, designated to be left standing within the cleared areas, of dead branches 1-1/2 inches or more in diameter; and trim all branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/4 inches in diameter with specified tree-wound paint.

D. Removal of Improvements: Remove existing above-grade improvements as indicated and as necessary to facilitate new construction.

3.2 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable or excess top soil from Owner's property.

END OF SECTION

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SECTION 31 20 00-EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Excavation, filling, grading, and compaction
2. Preparation of subgrade for building slabs, walks, and pavements.
3. Drainage course for slabs-on-grade.
4. Excavation and backfilling trenches within building lines.
5. Onsite and imported fill to bring areas to elevations indicated on drawings.
6. Stripping, stockpiling and subsequent distribution of topsoil.
7. Excavation, filling, grading, and compaction
8. Importing of specified soil materials not present on site.
9. Disposal of excess or unsuitable material off-site.
10. Maintaining site excavations free of water.
11. Testing as described herein (Testing Agency retained as per Division 1).

1.2 QUALITY ASSURANCE

A. Utilize equipment of proper size and in good working condition to prosecute the work to full completion in a satisfactory manner.

B. Utilize experienced personnel familiar with the equipment, methods and procedures for the job.

C. Coordinate construction activities with and schedule the Testing Agency (TA) representative to perform field tests and observations to assure compliance with this specification. A licensed geotechnical engineer must observe and approve the subgrade for all foundations, floor slabs and pavement areas.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM), Latest Edition.

1. ASTM D698, "Test Method for Moisture-Density Relationship of Soils."
2. ASTM D1557, 'Test Methods for Moisture-Density Relations of Soils."
3. ASTM D1556, "Test Method for Density of Soil In-Place, Sand-Cone Method."
4. ASTM D2922, 'Test Methods for Density of Soil In-Place by Nuclear Methods."
5. ASTM D2487, "Classification of Soils for Engineering Purposes" - Unified Soil Classification System
6. ASTM D2488, "Description and Identification of Soils"

B. A Geotechnical Evaluation Reports were was-prepared by Atlas Technical Consultants LLC, file Number 10-61187PW dated April 27. 2022. These reports contain information on site

soils, groundwater, grading and recommendations, and are available for reference from the Architect/Engineer (A/E). These specifications are intended to supplement the report, and not change any of the recommendations. Contact the A/E office for clarification if there is any conflicting direction.

1.4 RELATED WORK

A. Related Sections:

1. Section 00 31 32: Geotechnical Data
2. Section 01 50 00: Construction Facilities and Temporary Controls
3. Section 03 30 00: Cast-In-Place Concrete
4. Section 31 22 00 - Grading
5. Section 31 23 00: Excavating, Back-filling and Compacting for Pavement.
6. Section 31 23 16: Excavating, Back-filling and Compacting for Structures.
7. Section 31 12 00: Site Clearing and Grubbing for site stripping, grubbing, topsoil removal, and tree protection.
8. Section 321123 - Base Course
9. Section 32 12 16: Asphalt Paving for sub-grade preparation and compaction
10. Section 31 13 13: Concrete Paving
11. Section 32 32 19 - Unit Masonry Retaining Walls
12. Section 33 41 00 - Storm Water Pollution Prevention
13. Section 32 90 00: Planting: Final grading, together with placement and preparation of topsoil for lawns and planting.
14. Excavating and Backfilling or Fire Suppression, Plumbing, HVAC, Electrical and Communications Work: Refer to Drawings and Divisions 21, 22, 23, 26, & 27 Sections for excavation and backfill required in conjunction with underground utilities and buried plumbing, HVAC, electrical and communication appurtenances.

B. Coordination:

1. All surfacing work will be by related Section 312200. This section provides the earthwork required for a suitable sub-grade at the proper elevation. The related Sections 321216 and 321313 provides all the finishing work related to the surfacing which includes but is not limited to placement and final coordination with other related sections including this one.
2. Concrete unit retaining wall: This section provides a sub-grade for the segmental block retaining walls and stockpiles the backfill in the area. Reference Section 323219 Unit Masonry Retaining Walls for placement of the wall and backfilling. Coordinate access and depth of backfill material needed with the related wall specification section.
3. Final grade, seed, sod and mulch, is required by related sod and seed sections given above. Erosion control measures that may require interim seeding and mulch is required by this section, until the sub-grade is accepted by a related work section. After a related specification section accepts the sub-grade preparation, further earthwork related erosion, grading, etc. is generally accepted by that related section unless noted otherwise.

C. Subsequent Packages:

1. Topsoil piles: In areas identified to be left without topsoil, this construction package will provide topsoil piles uniformly distributed around the area with a volume adequate to place 8-inches of topsoil in all areas not indicated as building, walk or other pavements. These

pile sizes and locations will be reviewed and approved by the owner's construction manager.

1.5 SYSTEM DESCRIPTION

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes, Haul Permits and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.

1.6 REFERENCE SPECIFICATIONS

A. Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction", Latest Edition, Uniform Building Code (UBC), Latest edition, CBC Latest Edition and the approved Geotechnical Investigation Report prepared by the geotechnical engineer of record. Where the Reference Specifications are in conflict with these Specifications, these Specifications shall govern.

B. The Contractor shall review the approved Geotechnical Investigation report and its amendment letters prior to initiating any grading work.

1.7 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the re-use or disposal of materials removed.

1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer or Geotechnical Consultant. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below aggregate base, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

F. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

H. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

I. Compaction: Any method of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum dry density obtained by the test procedure described in ASTM D 1557 for general soil types abbreviated in this Specification as 90 percent of maximum dry density (unless noted otherwise).

J. Lift: A layer or course of soil placed on top of previously prepared or placed soil in a fill or embankment.

K. Unsatisfactory Material: Soil or other material identified as having insufficient strength or stability to carry intended loads without excessive consolidation or loss of stability.

L. Soil – Rock Fills: Defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps.

M. Rock Fills: Defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

N. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

P. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 C.Y. or more in volume than when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

1.8 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1. Location of borrow materials.
2. Location of temporary stockpiles (dirt) and oversize rock pile.
3. Photographs or video tape of existing adjacent structures and site improvements.

B. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 and with the following supporting data:

1. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Product Data: Submit "Letter of Conformance" in accordance with Section 01 33 00 and with the following supporting data:

1. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

1.9 EXISTING UTILITIES: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

A. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

1. Existing sub-surface structures, including old sewers, abandoned drains, etc., which may appear within the limits of excavation, shall be removed if required by the governing authority, but such removals will not be paid for separately, being included in the price paid for excavation or other items including such excavation.
2. In case the uncovering or interference of sub-surface structures necessitates a change in the alignment or grade of the proposed work, the Contractor shall give written notice of such condition, and shall cease work at such points until ordered to proceed.
3. In case any change of grade or alignment shall serve to delay the work, the time allowed for completion of the contract will be extended by the same length of time to which the delay shall have operated, the decisions of the [Architect] [Owner's Representative], being final.

B. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.

C. Provide minimum of 48-hour notice to Owner and Public Service Corporations who may be affected, and receive written notice to proceed before interrupting any utility.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active

E. USE OF EXPLOSIVES

A. The use of explosives is not permitted.

1.10 PROTECTION OF PERSONS AND PROPERTY

A. Barricade open excavations occurring as part of this work and post with warning lights.

B. Operate warning lights as recommended by authorities having jurisdiction.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

E. Protect trees, shrubs, lawns, and other features remaining as portions of final landscape.

F. Use all means necessary to protect the building, neighboring property, and materials that are to be salvaged. This protection shall be given to public walks, streets and utilities. Any damage to same shall be repaired by Contractor at his expense.

PART 2 - PRODUCTS

3.1 MATERIALS

A. Materials shall conform to requirements specified in this and related sections.

B. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

C. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SC, and SM; free of rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

D. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, MH, CH, OL, OH, and PT.

E. Backfill and Fill Materials: Satisfactory soil materials. ML and CL could be incorporated into fills with the approval of the Geotechnical Engineer.

F. Base Material: Shall conform to crushed aggregate base or crushed miscellaneous base in accordance with section 200-2.2 or 200-2.4, respectively, of the Reference Specification, and compacted to at least 95% of the maximum dry density as determined by ASTM Test Method D 1557.

G. Bedding Material: Shall be base materials with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve; or clean sand classified in accordance with ASTM D 2487.

H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 8 sieve.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 50 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

K. Topsoil shall be natural fertile friable loamy soil from a well-drained site, free of coarse sand, weeds, roots, and any sticks, stones or other extraneous matter over 1 inch in size. Architect shall approve topsoil in advance.

3.2 ACCESSORIES

A. Filter Fabric: Manufacturer's standard non-woven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:

   a. Grab Tensile Strength (ASTM D 4632): 100 lb.

   b. Tear Strength: 40 lbf; ASTM D4533

   c. Puncture Resistance: 50 lbf; ASTM D4833

   d. Water Flow Rate: 150 gpm per sf.; ASTM D4491

   e. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.

   f. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

B. Soil stabilizing emulsion for temporary erosion control.

1. Earth Guard Fiber Matrix manufactured by Terra Novo, Inc. or approved equal.

C. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6” wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric

2. Yellow: Gas, oil, steam, and dangerous materials

3. Orange: Telephone and other communications

4. Blue: Water systems

5. Green: Sewer systems

PART 3 - EXECUTIONS

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Prior to grading, demolish and remove existing improvements interfering with the new construction, including the existing asphalt pavement, curbs, sidewalk, and light poles, remnants of previous construction. In areas, which will not be further excavated, any void created from the demolition shall be properly backfilled to the limits determined by the geotechnical engineer. Any soils loosened or disturbed during the demolition shall also be removed. Removed pavements could be crushed, stored, and reused as Processed Miscellaneous Base, if the crushed material meets the required standard.

B. Provide erosion control measures per Section 312500 Erosion and Sedimentation Control to prevent erosion or displacement and loss of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Any old, uncertified fill encountered during grading shall not be used for support of structures, pavement, or other improvements. If encountered, old fill shall be removed from below and for a horizontal distance beyond structures and pavement of at least 5 feet, or for a distance equal to the depth of the excavation, whichever is greater. However, the actual depth and horizontal limits of any removals shall be evaluated during construction by the geotechnical engineer. Following removals, the area shall be backfilled with structural fill.

D. Tree protection is specified in Section 311200 Site Clearing and Grubbing

E. Prepare subgrade and place base materials in accordance with sections 301-1.2 and 301-2, respectively, of the Reference Specifications.

F. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.

G. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

H. Prior to construction, all existing sod, topsoil, and vegetation along with any soft/loose deposits that become obvious thereafter shall be completely removed from within the proposed building and pavement limits, and areas to be cut or receive fill.

I. Areas at grade or requiring fill should be leveled, compacted, and proof-rolled with a fully loaded dump truck making at least two (2) forward and back passes in each of two (2) perpendicular directions. This proofroll will serve to detect any near surface zones of loose, soft, or otherwise unstable material which may then be corrected per the recommendations of the qualified Soils Engineer who should witness the proofroll.

J. Following the proofroll and any remedial work that may be required, the building pad can be cut and filled to grade as required. Proper moisture conditioned site soil that is free of organic matter and rock larger than 6" in any dimension will be adequate for fill. If any must be imported, it is recommended that only granular soil be specified.

K. All surfaces cut to subgrade elevation or subgrade to receive compacted fill shall be proof-rolled under the direction of an on-site geotechnical engineer. Any soft, very loose, yielding, or obviously contaminated zones shall be undercut as directed by the geotechnical engineer. The undercut areas are to be backfilled with approved, compacted material.

L. Note: Revise paragraph below to suit project or recommendations of Geotechnical Engineer.

M. Any fill or backfill required within building and pavement limits shall be select material as approved by a qualified Soils Engineer. For all filling operations, the following should be observed:

1. Prior to use, the approved fill material shall be tested as outlined in ASTM D698 to determine the maximum dry density and optimum moisture content for silty or cohesive soils, or ASTM D4253 and D4254 for clean granular soils. For each change in borrow material, additional tests will be required.
2. For fill or backfill used for support of pavement or exterior slabs-on-grade, the fill material shall be placed on the approved subgrade in maximum 8” deep loose measured controlled lifts with each lift compacted to 90 maximum dry density of the [Standard Proctor per ASTM D698] at a moisture content within 2% of optimum for cohesive or silty borrow. Controlled lifts of granular material should be compacted to 95 relative density per ASTM D-4254.
3. For fill used within the building area, the fill material shall be placed on the approved subgrade in maximum 8” deep loose measured controlled lifts, with each lift compacted to 90 maximum dry density of the [Standard Proctor per ASTM D698] at a moisture content within 2% of optimum for cohesive or silty borrow. Controlled lifts of granular material shall be compacted to 95 relative density per ASTM D4254.
4. Soil in lawn areas should be compacted to 85 maximum dry density.
5. All filling operations requiring compaction shall be observed by a qualified soils technician with field density tests made, to assure compaction to Specification.

N. Cut site soils, excepting topsoil, may be used as compacted fill borrow. However, moisture control of soils is critical in attaining the required compaction.

3.2 EXCAVATION:

A. Remove and dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures, and utilities indicated to be removed.

B. All slab-on-grade structures shall be completely removed, including concrete and asphalt slabs, floor slabs, and foundations. Included in this category are garages, outbuildings, driveways, etc.

C. All basements and other miscellaneous buried structural units, including concrete slabs, walls, foundations, and abandoned utilities shall be completely removed to a depth of 3.0 feet below planned subgrade elevation.

D. All buried structural units located under, and within the building area to a lateral distance of four feet from the outer edge of new structural footings, shall be completely removed.

E. All slabs encountered, but which are located below the above cited minimum depths, shall be sufficiently broken throughout the slab thickness to permit any water traveling downward to pass through the slab and into the underlying soils.

F. All resulting debris should be wasted from the site.

G. Excavate for structure to elevations and dimensions shown, within a tolerance of plus or minus 0.10 foot, and extending excavation a sufficient distance to permit placing and removal of other work and for inspection. Trim bottom to required lines and grades to provide solid base to receive concrete.

H. Excavate for trenches to depth indicated or required and to establish indicated flow lines or invert elevations. Maintain uniform width required for particular item to be installed, including width to provide ample working room. Provide 6 to 9 inches clearance on both sides of pipe or conduit. Outside building, excavate trenches for water bearing piping so top of piping is not less than 3'-0" below finished grade.

I. Cut ground under pavements to comply with cross-sections, elevations, and grades indicated.

J. If on-site, materials are permitted, stockpile excavated materials where directed, until required for backfill and fill.

3.3 ROCK EXCAVATION:

A. Rock excavation in open excavations includes removal and disposal of solid rock, boulders over 1/2 cu. yd., ledge rock, rock-hard cementitious deposits, and other materials or obstructions which cannot be dislodged and excavated with modern, heavy-duty, track-mounted excavating equipment defined as follows:

B. For trenches less than 10 feet in width or for pits less than 30 feet in either length or width: Caterpillar Model 215C-LC or equivalent hydraulic excavator.

C. For open excavation (all excavations other than above): Caterpillar Model No. 973 or equivalent loader.

3.4 ROCK EXCAVATION CLASSIFICATION

A. Do not perform rock excavation work, if encountered, until material to be excavated has been classified by the Owner's Representative. Such excavation will be paid for in accordance with contract conditions relative to changes in work and the following:

B. Rock pavement lines are limited to the following:

1. Two feet outside of concrete work for which forms are required, except footings.
2. One foot outside perimeter of footings.
3. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width.
4. Actual outside dimensions of concrete work where no forms are required.
5. Under slabs on grade, 6 inches below bottom of concrete slab.

3.5 STABILITY OF EXCAVATION

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

1. Provide permanent steel sheet piling or pressure-creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

3.6 DEWATERING

A. Prevent surface water and subsurface or ground water from entering into excavations, from ponding on prepared subgrade, and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of

subgrade and foundations. Provide and maintain pumps, well points, sumps, suction, and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.7 COLD WEATHER PROTECTION:

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.8 BACKFILL AND FILL:

A. Place and compact acceptable soil material in layers to required elevations. Use soil material free of clay, rock or gravel larger than 2 inches in any dimension, debris, vegetable matter, waste, and frozen materials. Use subbase material where indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.

B. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

1. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by the Inspector of Record. Use care in backfilling to avoid damage or displacement of pipe systems.

C. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.9 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
2.

B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth

for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated. Correct improperly compacted areas or lifts as directed by the geotechnical engineer or the deputy grading inspector if soil density tests indicate inadequate compaction.

1. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust or discharge of sediment.

1. Coordinate stockpile location(s) with the Owner.
2. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
3. Stockpile oversize rocks separately from soils materials.

3.11 EXCESS MATERIAL DISPOSAL

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

D. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 31 22 00 - GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. General exterior grading, cutting and filling, including grading for building area, paving for traffic areas, planting areas, walks and ramps.
2. Sub-drain backfills for retaining walls and foundations.

C. Related Sections:

1. Section 0 12 70: Unit Prices
3. Section 0 12 10: Allowances
4. Section 31 23 00: Excavating, Back-filling and Compacting for Pavement.
5. Section 31 23 16: Excavating, Back-filling and Compacting for Structures.
6. Section 31 12 00: Site Clearing and Grubbing for site stripping, grubbing, topsoil removal, and tree protection.
7. Section 32 12 16: Asphalt Paving for sub-grade preparation and compaction.

1.2 SYSTEM DESCRIPTION

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.

1.3 REFERENCE SPECIFICATIONS

A. Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction", Latest Edition, Uniform Building Code (UBC), Latest edition, CBC Latest Edition and the approved Geotechnical Investigation Report prepared by the geotechnical engineer of record. Where the Reference Specifications are in conflict with these Specifications, these Specifications shall govern.

B. The Contractor shall review the approved Geotechnical Investigation report and its amendment letters prior to initiating any grading work.

1.4 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the re-use or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below aggregate base, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

F. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

H. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

I. Compaction: Any method of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum dry density obtained by the test procedure described in ASTM D 1557 for general soil types abbreviated in this Specification as 90 percent of maximum dry density".

J. Lift: A layer or course of soil placed on top of previously prepared or placed soil in a fill or embankment.

K. Unsatisfactory Material: Soil or other material identified as having insufficient strength or stability to carry intended loads without excessive consolidation or loss of stability.

L. Soil – Rock Fills: Defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps.

M. Rock Fills: Defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1. Location of borrow materials.
2. Location of temporary stockpiles (dirt) and oversize rock pile.

B. Photographs or video tape of existing adjacent structures and site improvements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to requirements specified in this and related sections.

B. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

C. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SC, and SM; free of rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

D. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, MH, CH, OL, OH, and PT.

E. Backfill and Fill Materials: Satisfactory soil materials. ML and CL could be incorporated into fills with the approval of the Geotechnical Engineer.

F. Base Material: Shall conform to crushed aggregate base or crushed miscellaneous base in accordance with section 200-2.2 or 200-2.4, respectively, of the Reference Specification, and compacted to at least 95% of the maximum dry density as determined by ASTM Test Method D 1557.

G. Bedding Material: Shall be base materials with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve; or clean sand classified in accordance with ASTM D 2487.

H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 8 sieve.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 50 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Filter Fabric: Manufacturer's standard non-woven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:

a. Grab Tensile Strength (ASTM D 4632): 100 lb.

b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.

c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

B. Soil stabilizing emulsion for temporary erosion control.

1. Earth Guard Fiber Matrix manufactured by Terra Novo, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Prior to grading, demolish and remove

existing improvements interfering with the new construction, including the existing asphalt pavement, curbs, sidewalk, and light poles, remnants of previous construction. In areas, which will not be further excavated, any void created from the demolition shall be properly backfilled to the limits determined by the geotechnical engineer. Any soils loosened or disturbed during the demolition shall also be removed. Removed pavements could be crushed, stored, and reused as Processed Miscellaneous Base, if the crushed material meets the required standard.

B. Provide erosion control measures per Section 312500 Erosion and Sedimentation Control to prevent erosion or displacement and loss of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Any old, uncertified fill encountered during grading shall not be used for support of structures, pavement, or other improvements. If encountered, old fill shall be removed from below and for a horizontal distance beyond structures and pavement of at least 5 feet, or for a distance equal to the depth of the excavation, whichever is greater. However, the actual depth and horizontal limits of any removals shall be evaluated during construction by the geotechnical engineer. After the removals the area shall be backfilled with structural fill.

D. Tree protection is specified in Section 311200 Site Clearing and Grubbing

E. Prepare subgrade and place base materials in accordance with sections 301-1.2 and 301-2, respectively, of the Reference Specifications.

F. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.

G. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.2 ROUGH AND FINE GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. All earthwork shall be performed in accordance with the requirements of California Building Code (CBC) - Latest Edition.

1. Notify the geotechnical engineer of a pre-grading meeting prior to the start of excavation/grading operations and anytime the operations are resumed after interruption.

2. Prior to grading, the existing improvements shall be demolished and removed, and existing utilities shall be removed, relocated, or protected, as appropriate, as discussed above.

3. All areas to be graded shall be stripped and cleared of any debris, vegetation, trees, topsoil, deleterious material or unsuitable materials. Roots of trees and bushes shall also be removed. Topsoil's may be reused in landscape areas; vegetation and deleterious materials shall be disposed of offsite.

4. The depth of excavations shall be achieved as specified in the project plans and specifications. The bottom of all excavations shall be observed by the geotechnical engineer, while the area is proof rolled with heavy construction equipment. Any loose/soft native soils or any old fill soils encountered shall be removed and replaced with structural fill. The depth of any removals required beyond the planned excavation limits shall be evaluated during construction by the geotechnical engineer.

5. Provide a smooth transition between existing adjacent grades and new grades.

6. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

7. All hillside grading or construction of fill slopes shall conform to the minimum standards listed in Chapter 70 of the UBC and the approved Geotechnical Report.

8. Fill slopes shall be keyed and benched into firm, natural ground when the existing slope to receive the fill is 5:1 or steeper (horizontal to vertical). Keys shall be tilted into the slope, shall be a minimum of one equipment width wide and shall be a minimum of three feet deep at the outside edge.

9. If necessary, the Contractor's selected equipment and construction procedure shall be altered, changed or modified in order to meet the specified compaction requirements. Flooding and water jetting is prohibited.

10. If abandoned utility lines are encountered during grading, they shall be properly capped and filled with a pressure-pumped sand-cement slurry (minimum 2-bag mix), or as directed by the geotechnical engineer.

11. If in the opinion of the geotechnical engineer, contractor or Construction Project Manager (CPM), an unsafe condition is created or observed during grading, that condition shall be reported to the CPM. Work in that area shall be stopped until measures can be taken to mitigate the unsafe condition. An unsafe condition shall be considered any condition that creates a potential danger to workers, on-site structures or construction, or any off-site properties or persons.

B. Rough grade area sufficiently high to require cutting by fine grading:

1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.

2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.

3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.

4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.

5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.

C. Base or Sub-grade:

1. After sub-grade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:

a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.

b. Sub-grade material shall be compacted by tamping, sheep’s foot rollers or pneumatic tire rollers. Required relative compaction shall be 95 percent minimum for the top 6 inches below sub-grade.

2. Tolerance of completed grades of base or sub-grade shall not vary more than:

a. Lawn or Unpaved Areas: Plus or minus 0.10 foot, unless otherwise indicated.

b. Concrete Walks: Plus or minus 0.05 foot.

c. Pavements:

1) Concrete: 0.02 foot minus, with no high spots.

2) Asphalt: 0.05 foot minus, with no high spots.

3) Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straight edge.

4) Provide an average grade as indicated.

D. Building Pad Certification: Upon completion of the sub-grade within building lines, perform a field survey by a licensed land surveyor and provide a map indicating the actual sub-grade elevations at each corner of the building pad, and at several intermediate points along the sides and the interior of the pad at grid of no more than 50 feet on center . Submit map to the civil engineer of record. Obtain a signed statement by the civil engineer that the pad has been completed per plan within the prescribed tolerances, and a signed statement by the geotechnical engineer or the deputy grading inspector that the compaction of the pad was completed in accordance with the geotechnical recommendations. Submit the signed forms to the Owner's Construction Manager. Excavation for foundations or construction of slab on grade shall not be done prior to acceptance of Pad Certification by the Owner's Construction Manager.

3.3 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety; Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.

C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.4 APPROVAL OF SUBGRADE

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. When Geotechnical Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrade damaged by rain, accumulated water, or construction activities, as directed by the Geotechnical Engineer.

3.5 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Geotechnical Engineer.

1. Fill unauthorized excavations under other construction as directed by the Geotechnical Engineer.

B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Geotechnical Engineer.

3.6 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust or discharge of sediment.

1. Coordinate stockpile location(s) with the Owner.

2. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3. Stockpile oversize rocks separately from soils materials.

3.7 EXCESS MATERIAL DISPOSAL

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.8 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

D. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 31 23 00 - EXCAVATING, BACKFILLING AND COMPACTING FOR PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Excavating, backfill, and compacting for paved areas.

2. Installation of fill materials.

C. Related Sections:

1. Section 312200: Grading.

2. Section 312333: Excavating, Backfilling and Compacting for Utilities.

3. Section 320117: Flexible Pavement Repair.

4. Section 321313: Site Concrete Work.

5. Section 311000: Site Clearing.

1.02 SYSTEM DESCRIPTION

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

A. Imported Soils: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.05 of this section.

1.04 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Division 1.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

PART 2 - PRODUCTS

2.01 BASE MATERIALS

A. Concrete Slabs On Grade: Provide "Crushed Aggregate Base "as specified in the Standard Specifications for Public Works Construction, Section 200: "Rock Materials," with ¾ inch maximum size aggregates. Provide 3-inch-thick base, unless noted otherwise.

2.02 FILL AND BACKFILL MATERIALS

A. Fill and backfill materials shall be previously excavated materials or imported fill material, free of clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and/or moisture content shall be blended and/or aerated to stabilize and upgrade the material.

C. Imported Fill Material:

1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.

2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site or incorporated in fill, if reviewed by a geotechnical engineer, retained by the Owner as an Owner Consultant. Unless otherwise required, no such materials may be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80-100
No. 100	0-8
No. 200	0-3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

PART 3 - EXECUTION

3.01 SITE PREPARATION

A. Clear the Project site as required in Section 02110: Site Clearing.

3.02 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

3.03 EXISTING UTILITY LINES

A. Protect existing utility lines from damage or displacement.

B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.04 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

3.05 FILL

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

B. Provide fill materials as specified in Part 2 – Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Division 1.

D. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.

E. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to a DSA approved independent approved testing laboratory for testing.

F. Initial sampling shall be performed by the geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.

G. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing tested for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

H. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the IOR, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the DSA as required by Title 24, CCR.

I. Bills of lading or equivalent documentation will be submitted to the IOR on a daily basis.

J. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary.

Unless otherwise reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this section.

3.07 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 90 percent.

C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D 1557, Method C.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 312316 - EXCAVATING, BACKFILLING AND COMPACTING FOR STRUCTURES

PART ONE - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Excavating, backfilling, and compacting for buildings and structures including retaining walls.

2. Fill materials.

C. Related Sections:

1. Section 312200: Grading.

2. Section 312333: Excavating, Backfilling and Compacting for Utilities

1.2 SYSTEM DESCRIPTION

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.3 SUBMITTALS

A. Imported Soils: A geotechnical engineer, retained by the Owner as a Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.05 of this section.

B. Shoring calculations as required in sub-section 3.03 of this section.

1.4 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. Sampling, testing, and certification of imported and/or exported soils shall be performed.

1.5 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

PART TWO - PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. Fill and backfill materials shall be a granular material previously removed from excavation, or imported fill material, free of large clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.

C. Imported Fill Material:

1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.

2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding sub-grade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site, or incorporated in fill, if reviewed by the geo-technical engineer, retained by the Owner as an Owner Consultant. Unless otherwise provided, no such materials may be imported from outside the Project site.

E. Permeable Backfill:

1. Permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

PART THREE - EXECUTION

3.1 SITE PREPARATION

A. Clear the Project site as required in Section 02230: Site Clearing.

3.2 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

C. Shore, crib, or lag excavations and earthen banks as necessary to prevent caving-in, erosion or gullying of sides.

D. Divert or de-water excavations until concrete is placed, forms are removed, and backfilling is complete.

3.3 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety, Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.

C. Remove shoring upon completion of Work, or when no longer needed, unless otherwise required by authorities having jurisdiction over the Work.

3.4 EXCAVATION

A. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required.

B. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.

C. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.

D. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

E. Calculate excavation quantities based on elevations or depths indicated on Drawings.

F. Provide 2000 psi concrete for backfill of over-excavated areas to indicated or required elevations

G. Special preparation of B.E.P. areas: Excavate areas designated on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.

3.05 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Section 01440.

C. Imported fill materials shall be sampled by the geo-technical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.

D. The geo-technical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to a DSA approved independent testing laboratory for testing.

E. Initial sampling shall be performed by a geo-technical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geo-technical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.

F. The geo-technical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the IOR, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geo-technical engineer shall submit a verified report to the DSA as required by Title 24, CCR.

H. Bills of lading or equivalent documentation will be submitted to the IOR on a daily basis.

I. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

3.6 BACKFILLING

A. After concrete has been placed, forms removed and concrete Work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris, and other waste materials from excavations before placing backfill.

B. Before installing any backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or damp-proofing against damage during backfilling operations with required protection board. Remove bracing as backfill operation progresses.

C. Do not furnish or install expansive soils for below grade building walls.

D. Install each layer of material in a not to exceed thickness of 6 inches, unless otherwise required.

E. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.

F. Install wall backfill before installing railings and fences on walls.

G. Impervious backfill materials shall be installed in layers along with and by the same methods specified for structure backfill. Impervious backfill materials shall be at the approximate grade and elevation and where exposed to erosion, shall be covered with at least a 12 inch layer of fill material as reviewed by the geo-technical engineer, retained by the Owner as an Owner Consultant.

H. Install drainage at the backside of walls per the drawings.

I. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

3.7 COMPACTING

A. Compact each layer of fill material by tamping, sheep's foot rollers or pneumatic-tired rollers, to such extent as to provide specified relative compaction. At inaccessible locations, compact to specified requirements with hand-held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least 95 percent.

C. Do not compact by flooding or jetting.

D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.8 INSPECTION AND TESTING

A. The geo-technical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The geo-technical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

D. The geo-technical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D 1557, Method C.

F. DSA will inspect foundation excavations when completed and ready for forms, after forms are in place and before first placement of concrete.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 33 - EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

C. Related Sections:

1. Section 311000: Site Clearing.
2. Section 312200: Grading.
3. Section 312333: Excavating, Backfilling and Compacting for Utilities.
4. Section 320117: Flexible Pavement Repair.
5. Section 321313: Site Concrete Work.
6. Section 331000: Site Water Distribution Systems.
7. Section 333000: Site Sanitary Sewer Systems.
8. Section 334000: Storm Drainage Systems.
9. Section 328400: Irrigation Systems.
10. Division 23: Mechanical.
11. Division 26: Electrical.

1.02 SYSTEM DESCRIPTION

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

A. Imported Soil: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product sample for testing in accordance with the terms of sub-section 3.05 of this section.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.

B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Division 1.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular business hours of Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.

2. Sand complying with the Specifications for cement concrete aggregates.

B. Backfill Materials:

1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2-1/2 inches in any dimension.

2. Cement-sand slurry shall be provided with 1 sack of cement per cubic yard of the mixture.

3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 - EXECUTION

3.01 GENERAL

A. Before excavation, contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.

B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Division 1 and in accordance with Cal-OSHA standards and requirements.

C. Saw-cut concrete or bituminous paving for trench installation.

D. Trenches over 5 feet in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety.

E. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

G. Do not install piping lengthwise under concrete walks without review by the Architect.

H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footings.

1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)

Irrigation Pipe:	non-pressure pipe - 12 inches, pressure pipe 24 inches

2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.

I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.

L. Do not install backfill until required inspections and testing is completed.

M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the IOR.

N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 95 percent of the maximum density.

O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.

P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.

Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 02765: Pavement Repair.

3.02 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Division 1.

C. Imported fill materials shall be sampled by a geotechnical engineer, retained by the City as a City Consultant, for compliance with the requirements of Part 2 of this section.

D. The geotechnical engineer, retained by the City as a City Consultant, shall perform the tests by utilizing an independent approved testing laboratory.

E. Initial sampling shall be performed by the geotechnical engineer, retained by the City as a City Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the City as a City Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.

F. The geotechnical engineer, retained by the City as a City Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the City, Architect and Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the City.

H. Bills of lading or equivalent documentation will be submitted to the City on a daily basis.

I. Upon completion of import operations, provide the City a certification statement attesting that all imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the City as a City Consultant, will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D 1557, method "C."

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section, which are hereby made a part of this Section of the Specifications.

B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT and GENERAL CONDITIONS.

C. Section Includes:

1. For sites where more than one acre of disturbance will occur: Prepare, certify and upload to the State SMARTS system a Stormwater Pollution Prevention Plan (SWPPP) for management of the site construction in compliance with the U.S. Clean Water Act, NPDES Construction General Permit (CGP) and file a Notice of Intent with the CA State Water Recourses Control Board (SWRCB)

2. Control measures to prevent all erosion, siltation and sedimentation of environmentally sensitive areas, wetlands, waterways, construction sites, adjacent areas and off-site areas. Control measures shall include Best Management Practices (BMPs) as specified in the project plans and documents, and per standard California Stormwater Quality Association (CASQA) details and specifications.

3. Implementation of the requirements of the Construction General Permit (CGP) Order 2009-0009-DWQ as amended by Order 2010-0014-DWQ (and its latest revisions) and those specified in Section 33 41 00 Stormwater Pollution Prevention.

4. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional cost to Owner.

5. Periodic maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each work day.

6. Inspection of erosion and sediment control structures for integrity shall be done per the Construction General Permit requirements. Any damaged device shall be corrected immediately.

B. Related Sections:

1. Section 013543 - Environmental Protection Procedures
2. Section 015000 - Temporary Facilities and Controls
3. Section: 310013 - Site Demolition
4. Section 311000 - Site Clearing and Grubbing
5. Section 312200 - Grading.
6. Section 312300 - Excavating, Backfilling and Compacting for Pavement
7. Section 312316 - Excavating, Backfilling and Compacting for Structures
8. Section 312333 - Excavating, Backfilling and Compacting for Utilities
9. Section 334100 - Stormwater Pollution Prevention
10. Section ~~312319 - Dewatering~~

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. The list provided below is not intended to be all inclusive of each regulation prevailing over the work. The latest version of the document listed shall govern the work performed.

A. State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, Waste Discharge Requirements (WDR's) for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Storm Water Permit) as amended, and/or modified.

2009-0009-DWQ Construction General Permit (Effective July 1, 2010)

B. California Storm Water Best Management Practices Handbook - Construction, January 2003, published by the California Stormwater Quality Association

(www.cabmphandbooks.com).

C. Caltrans Construction Site Best Management Practices Handbook, March 2003

(www.dot.ca.gov/hq/oppd/stormwtr/).

A. United States Environmental Protection Agency, Storm Water Discharges (applicable to State NPDES programs) 40 CFR 122.26.

1.3 DEFINITIONS

A. NOI: Notice of Intent (NOI) for coverage under the USEPA NPDES General Permit for Stomrwater Discharges Associated with Construction and Land Disturbance Activities.

B. NOT: Notice of Termination (NOT) ending coverage under the USEPA NPDES General Permit for Stomrwater Discharges Associated with Construction and Land Disturbance Activities. (General Construction Permit (GCP)).

C. NPDES: National Pollutant Discharge Elimination System

D. SWPPP: Stormwater Pollution Prevention Plan

E. USEPA: United States Environmental Protection Agency

F. CASQA: California Stormwater Quality Association (www.casqa.org)

G. BMPs: Best Management Practices

H. WDID: Waste Discharge Identification number

1.4 SCHEDULING AND SEQUENCING

A. WDID registration number shall be obtained from the Water Board prior to initiating any excavation and other land-disturbing activities, including demolition.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction and until the Notice of Termination has been accepted by the Water Board. On-site areas that are subject to severe erosion and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation shall be identified and receive special attention.

C. All land-disturbing activities shall be planned and conducted to minimize the size of the area exposed at any one time and the length of the time of exposure.

D. All land-disturbing activities shall be planned and conducted in a manner that minimizes damage from sedimentation discharge to off-site areas.

E. All temporary erosion and sedimentation control measures shall be removed from the site at the completion of the project. Proper disposal of erosion and sediment control materials shall be the responsibility of the Contractor.

1.5 SUBMITTALS

A. The Contractor shall submit each item in this Section according to the Conditions of the Contract and the Submittals Specification [Section 013300], for information only, unless otherwise indicated.

B. Submit to the Engineer, material specifications for any of the materials and equipment furnished under this Section.

1.6 QUALITY ASSURANCE

A. The Contractor shall comply with the requirements of the Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance with the General Construction Permit, which are incorporated herein by reference, and all applicable requirements of governing authorities having jurisdiction. The Specifications and Drawings are not represented as being comprehensive, but rather convey the intent to provide complete erosion and sedimentation control for both Owner's and adjacent properties.

B. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the site-specific Storm Water Pollution Prevention Plan or requirements of authorities having jurisdiction, whichever is more stringent.

C. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, the length of time of exposure, and to minimize sedimentation damage outside of the Limits of Work.

E. Surface water runoff originating up-gradient of exposed areas (run-on) should be controlled to reduce erosion and sediment loss during the period of exposure.

F. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.

G. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment controls is reduced by one-half.

H. The Contractor shall inspect, repair, and maintain erosion and sedimentation control measures as specified in the SWPPP for the project, and after storm events of greater than 1/2 inch, during construction until completion of the project.

I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

J. Upon removal of temporary erosion and sedimentation controls, restore and stabilize areas disturbed during removal.

K. Erosion and sedimentation control measures employed will be subject to approval and inspection by governing agencies having jurisdiction over such work. All erosion and sedimentation control measures and work shall be implemented and conducted in accordance with the standard details and specifications provided in CASQA's Stormwater Best Management Practice (BMP) Handbooks / Portal. More information can be obtained at (www.cabmphandbooks.com)

L. Fines and related costs resulting from failure to comply with the GCP requirements or to provide adequate protection against any environmentally objectionable acts and corrective action to be taken are the obligations of the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw Bales: Wire or nylon bound bales of straw, oriented around sides, rather than over and under.

B. Stakes: Stakes for bales shall be one of the following materials: Wood stakes of sound hardwood 2 by 2 inches in size or steel reinforcing bars of at least No. 4 size. Lengths shall be approximately three feet.

C. Fiber Logs: A fabric sock filled with wood cellulose fiber, coir fiber or other material intended to filter stormwater runoff and trap sediment.

D. Silt Fence: Filter fabric siltation fencing shall be a woven filter fabric having a permittivity of not less than 0.15 sec^{-1}, a water flow rate of a minimum 12 gallons per minute per square foot, and a grab tensile strength of a minimum of 90 lbs. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. Ultraviolet Radiation Stability 90 (%) min per ASTM G26.

E. Protective Measures: As temporary coverings on ground areas subject to erosion, provide one of the following protective measures, and as directed by the Inspector of Record.

1. Hay or straw temporary mulch, 100 pounds per 1,000 square feet.
2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.
3. Tackafier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring hay or straw.
4. Provide natural (jute, wood excelsior) or man-made (glass fiber) covering with suitable staples or anchors to secure to ground surface. Note that wire stapes

and non-biodegradable coverings shall not be used for any area that will be mown turf.

5. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw or hay free of undesirable weed seed.

F. Catch basin inserts: "silt-sack" type inserts shall be manufactured from a specially designed woven polypropylene geotextile and sewn by a double needle machine, using a high strength nylon thread or equal. Inserts shall be manufactured to fit the opening of the catch basin or drop inlet.

G. Wooden Stakes: Oak wood, minimum 1-inch by 1-inch, by minimum 36 inches long.

H. Stabilized Construction Entrance/Exit:

1. Geotextile: A non-woven geotextile fabric that meets the requirements of Section 213-2 of the *Standard Specifications for Public Works Construction (SWPPC) Latest Edition.* “Geosynthetics”, table 213-2.2(A) type 90N.

2. Aggregate: The proposed aggregate shall have the following gradation:

Sieve Designation	Square Mesh Sieves Percentage by Weight Passing
6 in.	100
5-1/2 in.	90 to 100
2-1/2 in.	15 to 20
¾ in.	0 to 5

PART 3 - EXECUTION

3.1 CATCHBASIN INSERTS

A. The Contractor shall install "silt sack" type or approved equal in catch basins in accordance with manufacturer’s instructions.

B. Drawing Appendix B in the project SWPPP provides an inventory of catch basins requiring protection including the width, length, and approximate depth to inverts. The Contractor is responsible to conduct a pre-construction survey of catch basins to verify site conditions with design drawings.

3.2 STRAW BALE BARRIERS

A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 inches.

B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale.

C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale to a minimum depth of 18 inches.

D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.

E. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4 inches on the uphill side. Loose straw shall then be scattered over the area immediately uphill from a straw barrier.

F. Inspection shall be frequent and repair or replacement shall be made promptly as needed.

3.3 FILTER SOCKS

A. Install in location as shown on the Drawings and as directed by the Engineer. Installation shall be performed in accordance with the manufacturer's instructions.

3.4 SILT FENCE

A. Install a filter fabric siltation fence prior to construction and remove after full surface restoration has been achieved. Install siltation fence as indicated on the Drawings. Install as follows:

1. Hand shovel excavate a small trench on the upstream side of the desired fence line location.

2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 1½ feet into the ground.

3. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.

4. Backfill the trench and compact. Compaction is necessary to prevent the runoff from eroding the backfill.

3.5 CONSTRUCTION ENTRANCE

A. The Contractor shall install the stabilized construction entrance at all points where traffic will be leaving the Site. The location of the stabilized construction entrance shall be proposed by the Contractor and approved by the Engineer.

B. The stabilized construction entrance shall be a minimum of 12 feet wide by 20 feet long with a minimum of 6 inches of aggregate.

C. The Contractor shall remove all vegetation and any objectionable material from the proposed location. Divert all surface runoff and drainage from the aggregate to a sediment trap.

D. Install the geotextile prior to placing any aggregate. The geotexile shall be placed in accordance with the manufacturer's instructions.

E. Place a minimum of six inches of aggregate on top of the geotextile.

3.6 INLET PROTECTION

A. Install silt fence or straw bales around inlet as specified herein.

3.7 DUST CONTROL

A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.

B. The frequency and methods of application for fugitive dust control shall be as directed by the Inspector of Record.

3.8 CLEANING AND MAINTENANCE

A. The Contractor shall clean all catch basins at the beginning and end of the Project.

B. The Contractor shall inspect the stabilized construction entrance every seven days. The Contractor shall check for mud and sediment buildup and pad integrity. The Contractor shall wash, replace, and/or add stone whenever the entrance fails to perform effectively or as directed by the Engineer.

C. The Contractor shall inspect the control system immediately after each rainfall and daily during prolonged rainfall. Make repairs immediately.

D. Remove and dispose of accumulated sediments when they reach fifty percent of the aboveground height of the control system, and when directed by the Engineer.

E. Any catch basin that collects sediments as a result of the Contractor activities shall be thoroughly cleaned out by the Contractor.

F. Replace control system promptly if fabric decomposes or system becomes ineffective prior to the expected usable life.

G. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Architect: mechanical “crimping” with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer's instructions for specific mulch material utilized.

H. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer's printed instructions.

I. Inspect protective coverings periodically and reset or replace materials as required.

J. Maintain or replace system until no longer necessary for intended purposes.

3.9 REMOVAL AND RESTORATION

A. The Contractor shall notify the Engineer upon completion of the work but prior to the removal of control structures.

B. The Contractor shall not remove the control structures until the Engineer approves removal.

C. The Contractor shall remove and dispose of all control system at completion of the work.

D. The Contractor shall spread remaining sediment to conform to grade.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

SECTION 321123 - BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Installation of base material.

C. Related Sections:

1. Section 31 10 00: Site Clearing.
2. Section 31 22 00: Grading.
3. Section 31 24 13: Excavating, Backfilling and Compacting for Pavement.
4. Section 32 01 20: Pavement Repair.
5. Section 32 13 00: Site Concrete Work.

1.02 SUBMITTALS

A. Prior to import, Contractor shall submit written certification to Owners Representative that crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082, and obtain written approval from CCCD of import at the subject site.

B. Crushed aggregate base (CAB) shall consist of native rock from pre-evaluated commercial source. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by CCCD prior to importing the material.

C. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.

D. Sample: Submit Sample of proposed base course material.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction (Green Book), current edition.

PART 2 - PRODUCTS

2.01 UNTREATED BASE MATERIALS

A. The following base materials shall conform with the requirements of Standard Specifications for Public Works Construction: Section 200 - Rock Materials.

1. Crushed Aggregate Base.

2. Crushed Miscellaneous Base.

B. Materials generated on site shall not be used as a base course material.

2.02 MATERIAL APPROVAL

A. Base material shall be inspected by the Owners Representative for gradation and material content prior to installation. The owner may choose to have additional tests performed by a geotechnical engineer, retained by the Owner, before installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.

B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 22 00: Grading.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 of Base Contract apply to this section.

B. Section Includes:

1. Paving for parking areas, access driveway, and area next to buildings.
2. Hot-mix asphalt paving.
3. Hot-mix asphalt patching.
4. Hot-mix asphalt overlays.
5. Asphalt surface treatments:
   a. Fog seals.

C. Related Sections:

1. Section 31 22 00: Grading.
2. Section 31 23 00: Excavating, Backfilling and Compacting for Pavement
3. Section 32 01 17 : Flexible Pavement Repair.
4. Section 32 01 13 : Rolled Slurry Seal, Existing Pavement

1.02 SUBMITTALS

A. Job-Mix Designs: For each job mix proposed for the Work.

B. Samples: 12 by 12 inches (300 by 300 mm) minimum, of paving geo-fabric.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction (SSPWC) "Green Book". current edition.

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

C. Testing Agency Qualifications: Demonstrate to Owner's Construction Manager satisfaction, based on Engineer's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work in public right-of-way.

E. Asphalt-Paving Publication: Comply with Asphalt Institute's "The Asphalt Handbook," except where more stringent requirements are indicated.

F. Pre-installation Conference: Review methods and procedures related to asphalt paving including, but not limited to, the following:

1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
2. Review condition of substrate and preparatory work performed by other trades.
3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.
5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.04 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B. A copy of the soils report is available for examination in the office of the Owner's Construction Manager during regular office hours and can be obtained from Architect as well.

C. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F .
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.

3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

D. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: Rock dust, hydraulic cement, or other inert material complying with ASTM D 242.

2.02 ASPHALT PAVEMENT MATERIALS

A. Asphalt Pavement Leveling Course: Conform to Viscosity Grade B-PG 64-10 in section 203-1.2 and section 203-6 of the Standard Specifications for PWC (Green Book).

B. Asphalt Pavement Wearing (Surface) Course: Conform to Viscosity Grade III C2-PG 64-10, C3-PG 64-10 in section 203-1.2 and section 203-6 and section 400-4 to be used with Class III asphalt of the Standard Specifications for PWC (Green Book).

C. Prime Coat: A prime coat consisting of grade SC-250 liquid asphalt shall be applied at a rate between 0.10 and 0.25 gallons per square yard, conforming to section 203-2 of the Standard Specifications for PWC (Green Book). Grade SC-70 liquid asphalt may be used when approved by Owner. Unless specified otherwise, prime coat shall be required on all aggregate base material or untreated subgrade on which asphalt concrete pavement is to be directly placed. The prime coat shall be allowed a cure time of 24 hours and any excessively oily areas shall be blotted with sand in preparation for application of asphalt concrete.

D Tack Coat: Emulsified asphalt grade SS-1h conforming to section 203-3 of the Standard Specifications for PWC (Green Book). A tack coat shall be required at all joints, overlays and overlaps.

E. Fog Seal Coat: A seal coat shall be applied to surface of all asphalt concrete no sooner than 24 hours after placement nor later than 14 days. Seal coat shall consist of an emulsion paving asphalt (Grade SS-1h) conforming to test requirements of Subsection 203-3.2 of the Standard Specifications. Seal coat shall be applied to provide a coverage of 0.05 to 0.10 gallon per square yard (exact rate to be determined by Owner). Seal coat shall not be applied when weather conditions are unsuitable or when atmospheric temperature is below 40F. Seal coat shall be applied to only one traffic lane at a time and the entire width of the lane shall be covered in one operation. The cut-off of asphaltic emulsion shall be made on building paper or similar suitable material spread over the surface. Traffic shall not be allowed on seal coat until emulsion breaks and seal coat is sticky to the touch and will not be picked up by traffic.

F. Asphalt Paint: Conform to ASTM D41 or D43 per section 203-8 of the Standard Specifications for PWC (Green Book).

The grading of combined aggregates and percentage asphalt shall be in accordance with Subsection 203-6.3 of the Standard Specifications. Unless specified otherwise, the following asphalt concrete mixtures shall be used:

1. All asphalt concrete except overlays:
    a. 2 to 3 inches thick: C2-PG 64-10
    b. More than 3 inches thick: base course of minimum 2-inch B-PG 64-10 and surface course of 1 inch to 3-inch C2-PG 64-10.
2. Overlays (2-inch maximum, leveling courses, and overlaps):
    a. Less than 1 inch thick: D2-PG 64-10
    b. 1 to 2 inches thick: C2-PG 64-10

DO NOT USE SLURRY SEAL OR FOG SEAL COATS SPECIFIED BELOW ON THE NEW PAVEMENTS.

For finishing of existing asphalt-concrete pavements, slated to remain:

A. Slurry Seal: Emulsified asphalt grade [SS-1h] [CSS-1h] and aggregate conforming to section 203.5 of the Standard Specifications for PWC (Green Book).

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

C. Prime Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

E. Fog Seal: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

F. Water: Potable.

2.02 HEADERS AND STAKES

A. Concrete: Per specification Section 02770.

B. Redwood
1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated.
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

2.03 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

D. Pavement-Marking Paint: See Section 32 17 23 pavement markings.

F. Glass Beads: AASHTO M-247.

G. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, approximately 6 inches (150 mm) high, 9 inches (225 mm) wide, and 60 inches (2130 mm) long length as shown, reinforced with two No. 3 deformed steel bars. Provide chamfered corners and drainage slots on underside, and provide holes for anchoring to substrate.
1. Dowels: Galvanized steel, diameter 3/4 inch, minimum length 10 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Subgrade, Subbase, and Base:
1. Proof-roll prepared [subgrade] [subbase] [base course] using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Engineer or Owner's Constructing Manager in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.02 COLD MILLING

A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and, as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.

1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

B. Cold mill existing asphalt concrete pavement in accordance with section 302-5.2 of the Reference Specification.

3.03 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.
2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly broken pavement. Prepare and patch with hot-mix asphalt.

C. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

D. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

E. Asphalt paint: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.

1. Allow asphalt paint to cure undisturbed before paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

D. Prime Coat: Comply with section 302-5.3 of the Reference Specification. Apply primer at a rate of between 0.20 and 0.25 gallons per square yard to top surface of base course prior to asphalt placement.

E. Tack Coat: If a leveling course has been used for construction traffic, apply tack coat to all leveling course surfaces in accordance with section 302-5.4 of the Reference Specification at a rate of 0.10 gallons per square yard.

F. Asphalt Paint: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

1. Allow asphalt paint to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.05 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Where redwood headers are indicated on drawing, fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place.

3.06 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

Construct asphalt pavement in accordance with section 302-5 of the Standard Specifications for Public Works Construction and as shown on the Drawings.

A. Thickness of Surfacing: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 3 inches.

B. Provide surfacing material over base course placed and compacted per the geotechnical recommendations.

C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.

D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.

E. At stairways, join surfacing to first tread or riser below first tread, at an elevation below first riser equal to height of risers of stairway.

F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.

G. Placing:

1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.

2. Where 3-inch thick surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2-1/2 inches in thickness unless otherwise required by the Architect.

H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent. Continuous screeds may be provided instead of stakes.

I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.

J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.

K. Rolling:

1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1-1/2 tons and 8 tons.

3. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to

grade, and meets requirements for specified smoothness. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.

3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.

4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D 1188.

L. Two Layer Method: The leveling course shall be installed to elevations which will allow the future placement of a wearing (surface) course no thinner than 1-1/2 inches. Prior to placing the wearing (surface) course, repair all areas damaged during construction use , thoroughly clean the leveling course of all loose material and place a tack coat pursuant to paragraph 3.04 D. herein.

3.03 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.
2. Offset longitudinal joints in successive courses a minimum of 6 inches.
3. Offset transverse joints in successive courses a minimum of 24 inches.
4. Construct transverse joints by bulkhead method or sawed vertical face method as described in “The Asphalt Handbook."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.04 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to at least 95 percent of the maximum density (ASTM D 2726-05a).

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt, with a thickness one inch greater than the existing, and to match existing finish surface grades such that no local ponding of water will result. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.05 TOLERANCE

A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10-foot straightedge is placed on surface.

B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.

C. Premium paving tolerances and requirements for synthetic track:

1. General: Test in-place asphalt concrete courses for compliance with requirements or thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Owner's representative.

2. Thickness: Tolerances for thickness shall be ¼ inch, plus or minus.

3. Planarity: The asphalt substrate shall not vary from the planned cross slope by more than +-0.1%. The finished asphalt shall not vary, plus or minus, under a 10 feet straight edge greater than 1/8". It is the responsibility of the paving contractor to flood test the surface with the use of a water truck. If, after 30 minutes on a 70-degree F day, "bird bath" are evident in a depth more than 1/8" the paving contractor, track surfacing contractor and the Owner's representative will determine the best method of correction.

4. Corrective Measures: It is the general contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the general contractor must notify the Owner in writing of the acceptance of the asphalt paving. This notification must include the acceptance of the paving by the track surfacing contractor.

5. No slurry or fog seals are to be applied to areas of asphalt paving that are to receive synthetic track surfacing. Problems with adhesion of synthetic surface are likely over seal coatings and warranty of the synthetic surfacing delaminating from the asphalt base will be voided.

3.06 TESTING

A. After first coat of surface seal has been installed and after a 24-hour period, the flood test shall be completed of the bituminous surfacing in presence of the IOR. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

3.07 RESURFACING

A. Temporary resurfacing: Unless permanent pavement is to be placed immediately, temporary resurfacing two (2) inches thick, or as specified, shall be placed and properly maintained until the permanent pavement is placed at locations as specified. In any event, in paved streets where immediate access is required to provide for public or private use, Contractor shall place and maintain said temporary pavement. Temporary pavement shall be placed at all locations which are not barricaded and are open to traffic. When Contractor delays the placing of temporary pavement, Owner reserves the right to have such pavement placed and to charge Contractor with the actual cost of all labor, material, and overhead required. Temporary resurfacing shall conform to Subsection 306-1.5.1 of the Standard Specifications and shall be placed as soon as trench backfill is suitable to receive it and shall remain in place until permanent resurfacing is commenced. Temporary resurfacing shall be removed and disposed of by Contractor prior to permanent resurfacing. The cost of furnishing, placing, maintaining, removing, and disposing of temporary resurfacing shall be included in the Contractor's bid price for related work if no bid item is specifically called out in the bid sheets.

B. Permanent Resurfacing: All permanent resurfacing, as a minimum, shall match existing pavement section thickness plus one (1) inch unless specified otherwise. Contractor shall remove all loose pieces of existing pavement prior to placing any pavement. Grinding of existing pavement edges may be required to make overlay flush. Said pavement shall be replaced in accordance with any requirements of the agency (State, County, City) having jurisdiction over the roadway.

3.08 SURFACE SEALING

A. After bituminous surfacing has passed flood test, clear and allow to dry and provide one more coat of surface seal as specified in Section 321236: Seal for Asphalt Paving.

B. Where indicated, provide multiple coats of surface seal to existing bituminous surfacing.

C. Where new bituminous surfacing joins existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 12 36 - SEAL FOR ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Surface sealer over bituminous surfacing.

C. Related Sections:

2. Section 32 12 16: Asphalt Paving.
3. Section 32 01 17 - Pavement Repair.
4. Section 32 17 23: Pavement Marking.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

A. Comply with the Standard Specifications for Public Works Construction, current edition.

B. Agitate bulk materials during transport.

1.04 MAINTENANCE

A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following surface seals:

Product Name	Manufacturer
Guard-Top	Industrial Asphalt
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
Super Drive Top.	SAF– T Seal. Inc.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

A. Install seal coat in strict accordance with manufacturer's written directions and recommendations.

B. Install 2 coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.

C. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

D. Where existing bituminous surfacing is indicated to be patched and sealed, install 2 coats of surface seal after patching. Refer to Section 32 12 16: Asphalt Paving.

3.03 PROTECTION OF SURFACES

A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.

B. Protect the Work of this section until Substantial Completion.

3.04 TESTING

A. Owner reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.

3.05 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 13 00 - ARCHITECTURAL CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Enriched (colored and/or special finish) concrete paving finishes (CONC-2).

B. Related Sections

1. Base Courses, Section 32 10 00.
2. Structural Concrete, section 03 30 00.
3. Sealants and Caulking: Section 07 92 00.

1.2 QUALITY CONTROL

A. Manufacturer's Directions:

1. Manufacturer's directions and drawings shall be followed in all cases where the manufacturers of articles used in the Section furnish directions covering points not shown in the Drawings and Specifications.

1.3 INSPECTION OF THE SITE

A. Verify conditions at site that affect work of this Section and take field measurements as required. Report any major discrepancies between drawings and field dimensions to the Architect prior to commencing work.

1.4 SUBMITTALS

A. Comply with Division 01.

B. Product Data:

1. Submit manufacturer's catalog data for all products used in this Section.
2. Submit color chart or samples for expansion joint sealant.

A. Shop Drawings:

1. Contractor shall submit shop drawings for expansion joints, cold joints, and decorative score line layout.

1.5 SUBSTITUTIONS

A. Substitutions shall be in accordance with Division 01.

B. Specific reference to manufacturer's names and products specified in this Section are used as standards of quality. This implies no right of the Contractor to substitute other materials without prior written approval.

C. Any materials installed without written approval may be rejected and the Contractor shall at his own cost remove such materials from the site.

1.6 SAMPLES

A. Design Samples: Provide up to 3 separate and individual samples of each type of color and finish of exposed finished concrete as indicated or as requested by the Architect. The purpose of this is to accommodate refinement and changes of the color and finish selection(s).

1. Design Samples shall be a minimum of 12" square and shall be warranted to represent results achievable at the site, but need not be prepared at the site.

B. Field Samples:

1. Provide 100 square feet of each type of concrete paving, score line and finish type for review by the Architect.
2. Field samples must match Design samples. Unacceptable field samples shall be demolished and removed from the site. New field samples shall be made until an acceptable sample is presented. Acceptable field samples may be retained in the Work.

PART 2 - PRODUCTS

2.1 PAVING TYPES

A. Concrete as specified in Section 03 30 00.

B. See CONC-2 on sheet A301A Materials List.

1. CONC-2: Paving Type ‘1’ (plaza paving and walkways):

a. Color: Natural Gray.
b. Finish: Top-Cast No. 3 retarder (alternate: Light Sandblast if accepted by Architect at time of field sample approval).
c. Joints: Sawcut 3/16-inch.

C. Water: ASTM C 94/C 94M; potable.

2.2 CONCRETE MATERIALS

A. Portland Cement: Refer to Site Work Concrete, Section 03 30 00.

B. Aggregate: Refer to Site Work Concrete, Section 03 30 00.

C. Water: Refer to Site Work Concrete, Section 03 30 00

D. Expansion Joint Materials:

1. Pre-molded expansion joint filler shall conform to ASTM D1751-6B size per plans, by Sonofoam or approved equal.
2. Joint sealant compound shall be two-part polyurethane sealant as manufactured by Sonneborn or approved equal. Sealant color as selected by Architect.
3. Submit color chart or color samples.

E. Reinforcement and Dowels: Refer to Concrete Reinforcing, Section 03 20 00, except as follows:

1. Slip Dowels: Dowels shall be #4 rebar x 12-inches long and free of dirt, grease, and oils. 50% of each dowel shall be encased in a plastic sleeve called "Speed Dowel" to allow parallel lateral movement of the dowel. Speed Dowel is distributed through Aztec Concrete Accessories at (909)829-2765.
2. Alternative proprietary cold joint systems may be proposed subject to Division 01 requirements for substitutions.

2.3 ADMIXTURES AND RETARDERS

A. Air Entrainments: Conforming to ASTM C260.

B. Chemical Admixtures: Conforming to ASTM C494 and ASTM C1017.

C. Water Reducing Admixtures: Shall conform to ASTM C260, Type A and not contain more than 0.1% chloride ions.

D. Top Surface Retarder: “Top-Cast” by Grace Construction Products or approved equal.

2.4 READY MIXED CONCRETE

A. Refer to Site Work Concrete, Section 03 30 00. 0.50 water to cement ratio maximum.

PART 3 - EXECUTION

3.1 PREPARATORY WORK

A. Verification of Conditions:

1. Examine areas and conditions under which work is to be installed.
2. Correct conditions detrimental to proper and timely completion of the work.
3. Starting the work constitutes acceptance of existing conditions.

B. Acceptance of Field Samples:

1. Install field samples of each type of concrete paving prior to commencing the work. The Architect will review for appearance, finish and joint accuracy.

3.2 DESIGN OF MIXES AND PROPORTIONING

A. Refer to Cast-in-Place Concrete, Section 03 30 00.

3.3 FORMING, PLACING AND CURING CONCRETE

A. Refer to Cast-in-Place Concrete, Section 03 30 00.

3.4 FINISHES

A. Finishes shall be as detailed on the drawings.

1. All exterior ramps shall be finished with a coarse hand trowel finish.

2. Finishes shall match approved field samples.

B. Top-cast Finish: Procedures per manufacturer recommendations.

C. Slip Resistance:

1. For slopes less than 6% surfaces shall be as slip resistant as that described as medium broom finish.
2. For slopes 6% or greater shall be as slip resistant as described as heavy broom finish.

3.5 JOINTING

A. Expansion and Construction Joints:

1. Construct in concrete paving as shown on the Drawings. 1/4" thick felt expansion joint material shall extend the full depth of the concrete being placed. The top of joint shall be flush with the specified grade.
2. All expansion joint filler strips shall be installed vertically and extend to the full depth and width of the work in which they are installed, and be constructed perpendicular to straight curb or radially to the line of the curb constructed on a curve. During placing and tamping of the concrete, the expansion joint shall be held rigidly and securely in proper position.
3. Foam expansion joint material, 1/2" thick X 3" high with 1/2" high removable portion, (to be removed prior to sealing). Install per manufacturers instructions. Deck-O-Foam is available from DCF Company, 13340 South Central Avenue, Los Angeles, California 90059, (213) 636-1214 or approved equal.
4. Caulk expansion joints with two-part polyurethane, non-sagging compound. Color of caulking shall match adjacent concrete color. Install per manufacturers instructions.
5. While the caulking is still tacky, apply a layer of sand matching concrete color and brush away any excess.

B. Control Joints:

1. Shall be 3/16" wide by 1 1/2" deep. All joints to be cut in a straight line with minimal over-cut. Use straightedge guide for alignment. At the edges of all saw cutting, i.e. curbs, walls, bands, etc., hand cut as necessary to achieve minimal over-cut.

3.6 CLEANING

A. Remove excess material from the site.

B. Remove concrete stains from adjacent surfaces.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: exterior Portland cement concrete paving for the following:

1. Curbs and gutters.
2. Walkways.
3. Site stairs, ramps.
4. Concrete aprons in front of trash enclosures.
5. Utility pads

1.3 SYSTEM DESCRIPTION

A. Provide concrete pavement according to the materials, workmanship, and other applicable requirements of the following standard specifications:

1. Reference Specification: Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction", Latest Edition. Unless otherwise noted, mention herein of section numbers refers to sections of the Reference Specification. Where Reference Specification refers to "Engineer", substitute the word "Architect". Where Reference Specification is in conflict with these Specifications, these Specifications shall govern.
2. Measurement and payment provisions and safety program submittals included in Reference Specifications do not apply to this Section.

1.4 GENERAL REQUIREMENTS

A. All concrete work shall be true to line and grade as indicated on the Drawings. The Contractor shall be responsible for proper drainage, without birdbaths, on all concrete paving surfaces. Any discrepancies or omissions on Drawings or conditions on the site that prevent the Contractor from providing proper drainage shall be brought to the attention of the Trustees' Representative in writing for correction or relief before work proceeds. All construction shall conform to current applicable codes and ordinances.

B. Piping: Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures to maximum. Verify size, length and location of electrical conduit. Sleeve any other piping.

C. Embedment: Anchor plates, inserts, and other items embedded in concrete shall be accurately secured so that they will not be displaced during placing of concrete.

D. Surface Tolerances: Finished paving surfaces shall not vary more than 1/4 inch when measured with a 10-ft. metal straightedge, except at grade changes. No “birdbaths” or other surface irregularities will be permitted. Correct irregularities to the satisfaction of Trustees’ Representative.

E. Portland cement concrete paving and concrete finishes: Portland cement concrete paving shall have a medium salt (medium broom) finish on all surfaces less than 6% and slip resistant (heavy broom finish) on all surfaces greater than 6%.

F. Testing

1. The Owners’ Representative will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. The Owners’ Representative will pay for costs of such tests. Contractor shall cooperate in making tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of sample at time of pour.

2. Refer to Division 1 for specific requirements of testing.

3. Should tests show that concrete is below specified strength; Contractor shall remove all such concrete as directed by Owners’ Representative. Full cost of removal of low-strength concrete, its replacement with concrete of proper specified strength, and testing shall be borne by Contractor.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

1.6 MOCKUP

A. Concrete mockup: Contractor shall provide 4’x4’ mock of all concrete with specified colors, finishes and joints in place.

1.7 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
4. Standard specifications for PWC (Green Book) latest edition, section 201-1.

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Work, materials, and color of the handicap ramp paving and detectable warnings shall conform to applicable sections of Americans with Disabilities Act (ADA) and California Accessibility Guidelines for Buildings and Facilities.

1.8 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Emergency Access: Maintain emergency access to surrounding buildings and public areas, clear and unobstructed at all time.

PART 2 - PRODUCTS

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
a. Debond Form Coating, L & M Construction Chemicals.
b. Crete-Lease 880 VOC, Cresset Chemical Company.

2.3 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 40 for #3 bars and Grade 60 for bars larger than #3, deformed.

B. Plain, Cold-Drawn Steel Wire: ASTM A 82.

C. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

D. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

2.4 AGGREGATES

A. Coarse aggregate for concrete paving:
   1. Shall be non-reactive aggregate. No Sun Valley aggregate shall be used. Contractor will submit a certificate stating that the aggregate has no history of reactivity and meets the ASTM standards
   2. Coarse aggregate for regular-weight concrete shall be hard, curable, uncoated, washed, graded, cleaned, and screened crushed rock or gravel conforming to current requirements of ASTM Designation C33.
   3. Coarse aggregate for paving shall not exceed 3/4 inch.
   4. Use same aggregate from single source throughout entire project.

B. Aggregate for retarded finish shall be 1/4” to 5/8” water-washed #4 pea rock with smooth edges.

C. Fine aggregate:
   1. Sand shall be clean, hard, and durable with uncoated grains
   2. Free from injurious amounts of silt, loam, clay or other deleterious matter,
   3. Conforming to ASTM Designation C33,
   4. Graded in size from coarse to fine with 95-100% by weight passing a No. 4 sieve, 45-70% passing a No. 16 sieve, 15-30% passing a No. 50 sieve, and 3-8% passing a No. 100 sieve.
   5. Use same sand from single source throughout entire project.

2.5 WATER

A. Provide clean, potable concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials, or other deleterious matter.

2.6 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type V, low alkalai.

   1. Use one brand of cement throughout Project. Coordinate with Division 3 Section "Cast-In-Place Concrete."

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33, Class 4M non-reactive, and as follows. Provide aggregates from a single source.

   1. Maximum Aggregate Size: 1-inch

   2. Do not use fine or coarse aggregates that contain substances that cause spalling.

   3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

D. Water: Potable.

2.7 ADMIXTURES

A. Provide concrete admixtures that contain no more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

G. Products: Subject to compliance with requirements, provide one of the following:

1. Air-Entraining Admixture:
   a. Air-Mix or Perma-Air; Euclid Chemical Co.
   b. Darex AEA or Daravair; W.R. Grace & Co.
   c. MB-VR or Micro-Air; Master Builders, Inc.
   d. Sealtight AEA; W.R. Meadows, Inc.
   e. Sika AER; Sika Corp.

2. Water-Reducing Admixture:
   a. Eucon WR-75; Euclid Chemical Co.
   b. WRDA; W.R. Grace & Co.
   c. Pozzolith Normal or Polyheed; Master Builders, Inc.
   d. Plastocrete 161; Sika Corp.

3. High-Range Water-Reducing Admixture:
   a. Eucon 37; Euclid Chemical Co.
   b. WRDA 19 or Daracem; W.R. Grace & Co.
   c. Rheobuild or Polyheed; Master Builders, Inc.
   d. Sikament 300; Sika Corp.

4. Water-Reducing and Accelerating Admixture:
   a. Accelguard 80; Euclid Chemical Co.
   b. Daraset; W.R. Grace & Co.
   c. Pozzutec 20; Master Builders, Inc.
5. Water-Reducing and Retarding Admixture:
   a. Eucon Retarder 75; Euclid Chemical Co.
   b. Daratard-17; W.R. Grace & Co.
   c. Pozzolith R; Master Builders, Inc.
   d. Plastiment; Sika Corporation.

2.8 COLOR ADMIXTURE

A. Color admixture shall be suitable for flatwork concrete and shall meet or exceed the requirements set by Portland Cement Association (PCA) and ATSM C 494.

B. Color admixture shall be of a type and quality which will not adversely affect workability, setting, or strength of concrete. Color pigments shall consist of chemically inert, non-fading, alkali-fast mineral oxides, finely ground and specially prepared for the use in both cement and mortar. Admixture shall not contain calcium chloride.

C. Color admixture shall be admixture as noted on Landscape drawings, manufactured by Davis Colors, 3700 East Olympic Blvd., Los Angeles, CA 90023.

2.9 SURFACE RETARDER

A. Water-based top surface retarder for poured-in-place flat-work. Grades of retarder simulate acid-etched concrete through heavy sandblast finish.
   a. Grace Top-Cast, manufactured by W.R. Grace & Co.
   b. Top-Etch Surface Retarder, manufactured by Unitex.
   c. Or Equal.

2.10 CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
   1. Waterproof paper.
   2. Polyethylene film.
   3. White burlap-polyethylene sheet.

C. Liquid Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B. Moisture loss not more than 0.55 kg./sq. meter in 72 hours when applied at a rate of 200 sq. ft./gal.
   1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. L & M Cure R, L & M Construction Chemicals, Inc.
      b. 1100-Clear, W.R. Meadows, Inc.
   3. Do not use sodium silicate type curing agents.

2.11 RELATED MATERIALS

A. Bonding Agent: Acrylic or styrene butadiene, complying with ASTM C 1059, Type 2

B. Epoxy Adhesive: ASTM C 881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

C. Products: Subject to compliance with requirements, provide one of the following:
   1. Bonding Agent:
      b. SBR Latex; Euclid Chemical Co.
      c. Daraweld C; W.R. Grace & Co.
      d. Everbond; L&M Construction Chemicals, Inc.
      e. Acryl-Set; Master Builders Inc.
   2. Epoxy Adhesive:
      a. Burke Epoxy M.V., The Burke Co.
      b. Concresive Standard Liquid; Master Builders, Inc.
      c. Rezi-Weld 1000; W.R. Meadows, Inc.

D. Concrete Sealer: Water-based, deep penetrating, non-staining, non-darkening silane micro emulsion.
   1. Positive chloride-ion screening, prevents water intrusion, minimizes rebar corrosion and potential concrete spalling, and protects against damaging effects of alkalis and other contaminants.

2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following::

   a. Pentane WB, L & M Construction Chemicals, Inc. This product is intended to establish the characteristics and level of quality intended for this Project.

2.12 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the Owner's field quality-control testing agency as the independent testing agency.
2. Limit use of fly ash to 25 percent of cement content by weight.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 3200 psi min for Concrete for pavement, 2500 psi min for site flatwork and 4000psi min for Concrete for structures.
2. Maximum Water-Cement Ratio at Point of Placement: 0.5 maximum for Concrete for pavement and site flatwork and 0.45 maximum for Concrete for structures.
3. The minimum cement content shall be 5-1/4 sacks per cubic yard.
4. The maximum concrete slump shall be 3 inches, plus or minus 1/2 inch, for all walks; and 4 inches, plus or minus 1 inch for all other Portland cement concrete.
5. Water/Cement Ratios:
   a. Slabs-On-Grade: 0.45.
   b. All Other Paving: 0.5.
6. Maximum aggregate size: 1/2 inch for flat work
7. Color additive: see landscaping specifications for specific requirements.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content as follows with a tolerance of plus or minus 1-1/2 percent:
1. Air Content: 2.5 to 4.5 percent.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.14 HERBICIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wettable powder form.

1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. Ciba-Geigy Corp.
b. Dow Chemical U.S.A.
c. E.I. Du Pont de Nemours & Co., Inc.
d. FMC Corp.
e. Thompson-Hayward Chemical Co.
f. U.S. Borax and Chemical Corp.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared subgrade, base, or subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase prior to application of prime coat.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

3. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys for pavement 6 inches or thicker, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.

2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

3. Provide tie bars at sides of paving strips where indicated.

4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 25 feet, unless indicated otherwise.

2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Installation of joint fillers and sealants is specified in Division 7 Section "Paving Joint Sealants."

F. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

G. Where spacing is not shown, locate expansion joints at 10-foot maximum spacing.

H. Where plastic "zip strips" are used to construct concrete joints, cut and remove, as a minimum, the top 1/4 inch of these strips after concrete has cured, and coordinate installation of joint filler, if shown on the Drawings.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.

F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

K. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paving machine during operations.

L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

M. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
   3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
   1. Burlap Finish: Drag a seamless strip of damp burlap across concrete, perpendicular to line of traffic, to provide a uniform gritty texture finish.
   2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

4. Do not use troweling machines within 12 inches of electrical junction and outlet boxes which are set to finish flush with concrete slabs. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.

B. Finishing formed surfaces:

1. Curb forms shall leave a smooth face.

2. Remove all fins.

C. Provide steel trowel finish on tops of curbs and flow lines of curbs, gutters and integral curb and gutters.

D. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 1/4 inch.

2. Radius: 3/8 inch.

E. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.

F. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing to harden.

G. Apply integral wood float and broom finish to the all concrete pavements and walkways, unless otherwise shown on the Drawings.

1. After screeding and compacting, finish with a wood float using a circular motion to produce a uniform texture and finish throughout.

2. For vehicular traffic areas, the finish shall be coarse enough to provide a non-slip surface with a minimum static friction coefficient of 0.6.

3. For pedestrian traffic areas, finish shall be a non-slip surface with a minimum static coefficient of friction of 0.6.

a. For ramps, the static coefficient of friction shall be a minimum of 0.8. Ramps are defined as any sloping path of travel with a slope in the direction of travel of 5.0%, or greater.

4. Tests for coefficient of friction shall be either ASTM C-1028 (field test) or ASTM D-2047 (laboratory test).

3.7 SPECIAL FINISHES

A. Non-slip Aggregate Finish: Apply non-slip aggregate finish to paving surfaces indicated.

1. After completing float finish, uniformly spread 25 lb of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.

2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

B. Dry-Shake Color Hardener Finish: Apply a dry-shake color hardener finish to indicated paving surfaces as follows:

1. Uniformly apply dry-shake materials at a rate of 100 lb per 100 sq. ft., unless a greater amount is recommended by material manufacturer.

2. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the dry-shake material over the concrete surface with a mechanical spreader, and embed by power floating. Follow the floating operation with a second shake application, uniformly distributing the remainder of the dry-shake material to ensure uniform color, and embed by power floating.

3. After final floating, apply a light hand-trowel finish followed by a broom finish to concrete. Cure concrete with a curing compound recommended by the dry-shake material manufacturer. Apply the curing compound immediately after final finishing.

C. See landscape architects' plans and specifications for details on colors and finishes related to exposed-aggregate, pattern-stamped, pattern-rolled, or inlaid patterns.

D. Detectable Warnings: Truncated domes and all related installed surfaces to be installed according to manufacturer’s specifications. All detectable warning surface installations shall be at minimum, at least as nonskid as the surrounding pedestrian surfaces. Concrete must cure for 15 days prior to truncated dome plates installation to insure proper bonding. All concrete coloring/additives shall be integral, not surface applied. All “surface curing” compounds or sealers shall be removed by method of grinding on any concrete that is less than 6 months old before truncated dome plates are installed. Surface finish should be medium broom finish for maximum adhesion.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL TESTING

A. Employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:

B. The Owner will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:
   1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
      a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
      b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
      c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
      d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
      e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
   2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

C. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section. Concrete which is not true to line and plane, which is not thoroughly troweled and properly surfaced as required, which varies in excess of 1/4-inch along a 10-foot straight edge, which is scuffed or has a rough top surface, except where required, or which does not connect properly to adjoining work, does not slope as required for drainage or is not properly cured, will be deemed defective.

1. General: Patch defective areas immediately following form removal. Remove defective concrete to a width and depth necessary for proper patching, but in no case less than 1 inch deep. Make the walls of the cut area perpendicular to the surface and do not feather out the edge. Dampen the patch area and the adjacent area 6 inches around the patch area.

2. Exposed concrete: Prepare a patching mortar of one-part portland cement, adjusted to match the color of the surrounding concrete, and 2-1/2 parts sand with the least water required to produce a workable mass. Re-work this mortar until it is the stiffest consistency that will permit placing. Brush the patch area with a bond of neat cement and water paste and apply patching mortar when the water sheen is off the bond. Strike off the mortar slightly higher than the surrounding surface, let set for 1 hour and finish flush with the surrounding surface.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

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SECTION 32 13 73 - CONCRETE PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone paving joint sealants.

B. Related Sections:

1. Section 32 13 16 "Asphalt Paving" for formation of joints between concrete and asphalt pavement.
2. Section 07 92 00 "Joint Sealants" for non-traffic and traffic elastomeric joint sealants for applications other than those specified in this section.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM): www.astm.org:

1. ASTM C 1193 - Standard Guide for Use of Joint Sealants.
2. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
3. ASTM D 5893/D 5893M - Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of paving sealant product specified, including:

1. Preparation instructions and recommendations.
2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project. Indicate width, width-to-depth ration, thickness of joint sealant, and depth of recess limitations recommended by manufacturer.
3. Recommended primers and accessories.
4. Sample for Color Selection: For each paving sealant type.
5. Sample for Verification: For each paving sealant product, provide samples in color offered with joint sealants formed between two 6-inch- long strips of material matching appearance of surfaces adjacent to joint sealants.

PART 2 - PRODUCTS

A. Compatibility: Provide paving sealants and accessory materials that are compatible with joint substrates and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer by testing and related experience.

B. Standard Compliance:

1. Paving sealants: Comply with ASTM D 5893 and other specified requirements for each liquid-applied paving sealant.
2. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, Or.

i. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, Or.
ii. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated. Or an Approved Equal.

Pick only one of those sealants, such that it offers colors compatible with the concrete pavement color specified by the landscape architect.

Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, non-sag silicone sealant complying with ASTM D 5893 for Type NS.

Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

Multi-component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

Available Products: Subject to compliance with requirements, cold-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:

1. Paving joint sealant products manufactured by Dow Corning Corporation, Midland MI; (877) SEALANT (877) 732-5268); email: construction@dowcorning.com

2. Paving joint sealant products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing Division, An RPM Company, Beachwood OH; (866) 321-6357; email: techresources@tremcoinc.com; www.tremcosealants.com,

3. or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements

2.2 HOT-APPLIED JOINT SEALANTS

Jet-Fuel-Resistant Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3569.

2.3 PRIMERS

Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joint profiles and surfaces to determine if work is ready to receive paving sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with paving sealant work once conditions meet sealant manufacturer's recommendations.

1. Joint Size Limitations: Comply with width, width-to-depth ration, thickness of joint sealant, and depth of recess limitations published by manufacturer for specific products.

3.2 PREPARATION

A. Joint Surface Cleaning: Clean joints not more than two hours prior to installing paving sealants using materials and methods recommended by sealant manufacturer.

1. Remove laitance, form-release agents, dust, and other contaminants.
2. Porous surfaces: Grinding, saw cutting, sand or water blast cleaning, or mechanical abrading followed by vacuum cleaning or blasting with oil-free compressed air.
3. Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C 1193.

B. Rehabilitation of Existing Paving Joints: Remove existing joint sealant materials. Clean joints and remove joint sealant residue. Repair deteriorated or damaged substrates as recommended by sealant manufacturer to provide suitable substrate. Allow substrate patching materials to cure prior to application of new joint sealant.

C. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

D. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

1. Apply primer to concrete and other substrates as recommended by manufacturer or indicated as result of sealant adhesion test.
2. Apply primer with brush or clean cloth moistened with primer. Uniformly coat surface but do not saturate.
3. Allow to dry according to manufacturer's recommendations prior to sealant application.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Install sealants using methods recommended by sealant manufacturer unless more stringent requirements are indicated. Comply with recommendations in ASTM C 1193.

B. Joint Backing: Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of paving sealant allowing optimal sealant movement. Install continuously without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.

1. Install bond breaker tape over substrates when sealant backings are not used.

C. Sealant Application: Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.

1. Use sealant-dispensing equipment to push sealant bead into opening. Fill joint opening to full and proper configuration. Apply in continuous operation. Ensure sealant fills entire joint and firmly contacts all surfaces.
2. Tool non-sag type sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.

a. Provide concave, smooth, uniform, sealant finish. Eliminate air pockets and ensure complete contact on both sides of joint opening.
b. Tool joints with one continuous stroke.

c. Using tooling agents recommended by sealant manufacturer for application. Do not use water, soap, or alcohol to facilitate tooling.

D. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.

1. Remove masking tape after tooling joint without disturbing seal.
2. Remove excess sealant while still uncured.

E. Curing and Protection: Allow sealant to skin over and follow manufacturer's recommendations prior to allowing exposure to traffic. Use test specimens formed at time of sealant application to verify curing time. Prevent damage to joint sealants resulting from construction operations or other causes. Replace damaged joint sealants at time of Substantial Completion.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer’s instructions and with ASTM C1193, Method A.

1. Perform [5] tests for the first 500 feet of joint length for each kind of sealant and joint substrate or 1 test per each floor per building elevation, minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

END OF SECTION

SECTION 32 15 40 - DECOMPOSED GRANITE PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide Stabilized Decomposed Granite Paving, complete as shown, and as specified.

B. Related Sections:

1. Section 329000 “Landscape Planting”

1.3 REFERENCES

A. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D2419 – Sand Equivalent Value of Soils and Fine Aggregates.

C. “Greenbook” Standard Specifications for Public Works Construction.

1.4 DEFINITIONS

A. Percent Compaction: ASTM D1557, percentage of the maximum in-place dry density of the same material as determined by Soils Engineer.

1.5 SUBMITTALS

A. Product Data: Manufacturer's current catalog cuts and specifications for decomposed granite and herbicide, and edging, and installation instructions.

B. Samples: Half (1/2) a pound for each size and color range of decomposed granite.

C. Mock-up: Create on site sample panel 6’ x 6’ section, full depth to match finish condition including base course and edging, for review by Architect.

D. Test Reports: Certified copies of field tests of compressive strengths of decomposed granite paving.

1.6 QUALITY ASSURANCE

A. Qualifications: Submit certified documentation of successful experience of no less than three (3) years in the installation of similar crushed stone paving.

B. Installation: Performed only by skilled work people with satisfactory record performance on landscaping or paving projects of comparable size and quality

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect from contamination with foreign materials. Isolate stockpiles to prevent mixing of different aggregate grades. Prevent contamination of organic materials.

B. Protect DG Screenings from damage during delivery and store under tarp when time of delivery to installation exceeds one week to reduce loss of Granite fines & mitigate separation of particle sizes.

1.8 SITE CONDITIONS

A. Review installation procedures and coordinate DG work with other work affected.

B. All hard surface paving adjacent to DG areas, including concrete walks, driveways, and fountain work, must be completed prior to installation of DG Surface.

C. Protect partially completed paving against damage from other construction traffic when work is in progress. Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.

D. Do not install stabilized decomposed granite surfacing when subbase is wet at saturated field capacity. Do not install decomposed granite during rain or while sub-base is wet from rain.

1.9 SEQUENCING

A. Acceptance: Do not install work under this section prior to acceptance of sub-grade preparation under another section.

B. Coordinate work specified in this Section with work specified in other Sections to minimize cutting of and operation of heavy equipment over installed stabilized decomposed granite surfacing. Coordinate with other trades to insure the following:

1. Irrigation Sleeving: To be placed prior to placement of aggregate base.

1.10 MAINTENANCE

A. Service: Immediately repair all damage to the work as the result of weather or traffic conditions. Report all damage resulting from work of other trades after acceptance of decomposed granite work. Repair to match adjacent undisturbed work.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Southwest Boulder & Stone
2. Decorative Stone Solutions.
3. Or approved equal.

2.2 MATERIALS

A. Decomposed Granite: as specified in the plans shall be derived from the crushing and screening of naturally friable granite. The blending of course sand, with rocks dust is not permitted.

1. Base Course: material from local sources commonly used for road base construction, passing the following sieve analysis as determined by ASTM C136 methodology

% Passing	Sieve Size
100	1/2”
90-100	3/8”
50-100	No.4
25-55	No.30
10-20	No.100
5-18	No.200

2. Sand equivalent: as determined by ASTIM D 2419 methodology (Caltrans 217): minimum of 30.

3. R-value: as determined By ASTM D2488 methodology (Caltrans 301): minimum of 70.

4. Color: As Indicated on Drawings

B. Stabilizing Organic Binder: Enviroseal M10 or approved equal. Shall have a minimum swell volume of 32 ML/GM and be approved by the city. The binder should be incorporated with the granite fines per the manufacturer's recommendations and as approved by the Owner. Blending with the use of bucket loader or similar is not acceptable. The mixing facility and mixing method shall be available to the city for inspection upon request.

2.3 BASE COURSE MATERIAL

A. Comply with Greenbook Section 200-2 – "Untreated Base Materials"

2.4 ACCESSORIES

A. Water: Fresh, clean, potable water as available from the State. Transport as required. Free from contaminants that would discolor or be deleterious to stabilized decomposed granite surfacing.

B. Steel Edging:

1. Headers shall be 'Permaloc Aluminum Edging' 3/16" x 16'-0" Black or Bronze Anodized-electrically absorbed dyes into the outer layers of the aluminum, based on locations indicated in drawings. Supply 16"-0" sections with stake loops every 24" along the section, 0.110" for 3/16" gauge wall thickness; and to include eight (8)-12" aluminum stakes. Stakes are to be 6061 alloy, T-6 hardness. Manufactured by Permaloc Corp. 1-800-356-9660.

2. Thickness: 1/8 inch (3.2 mm) gage section at 0.072 inch (1.83 mm) minimum thick with 0.135 inch (3.4 mm) exposed top lip and 3/16 inch (4.8 mm) gage section at 0.116 inch (2.95 mm) minimum thick with 0.187 inch (4.75 mm) exposed top lip.

3. Length: 8' (2.44m) sections.

4. Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design.

5. Stake: 12" (305mm) Permaloc extruded aluminum stake. Stakes to interlock into section loops.

6. Finish: To be selected by Architect from Manufacturer's full range. Paint finish shall comply with AAMA 2603 for electrostatically baked on paint.

7. Installation:

a. Preparation: Ensure that all underground utility lines are located and will not interfere with the proposed edging installation before beginning work. Locate border line of edging with string or other means to assure border straightness and curves as designed. Dig trench 1 inch (25 mm) deeper than set of edging bottoms.

b. Set edging into trench with top at 1/2 inch (12.7 mm) above compacted finish grade on turf side with side having loops for stakes placed on opposite side of turf. Drive stakes through edging loops until locked in place. Requires 5 stakes evenly spaced for each 16 feet (4.88 meters) section, or 3 stakes evenly spaced for each 8 feet (2.44 meters) section with a total of 8 stake loops available in each 16 feet (4.88 meters) section if necessary. Provide additional stakes at approximately 24 inches apart, longer stakes, heavier gage stakes, or any combination of previously mentioned as necessary to firmly secure edging for permanent intended use.

c. Where edging sections turn at corners and at angled runs, cut edging partially up through its height from bottom and turn back to desired angle to form rounded exposed radius.

d. Backfilling and Cleanup: Backfill both sides of edging, confirm and adjust if necessary that sections are securely held together, and compact backfill material along edging to provide top of edging at 1/2 inch (12.7 mm) above turf finish grade. Cleanup and remove excess material from site.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Sub-grades shall have been rough graded to within 0.10 ft. of finish grades less depth of decomposed granite paving.

B. Verify that concrete bands or adjacent paving and irrigation sleeving have been installed and accepted under another Section prior to commencement of work.

3.2 PREPARATION

A. Compaction: After completion of soil sterilization, compact sub-grade to minimum 90% compaction.

B. Excavation: Excavate to depth required so edges of stabilized decomposed granite surfacing will match adjacent grades and have a maximum cross slope of 1 percent.

C. Subgrade Preparation: Comply with Greenbook Section 301-1 – “Subgrade Preparation.”

D. Geosynthetic Fabric: Comply with Greenbook Section 300-10 – “Geotextiles for Separation”. Do not extend beyond limits of stabilized decomposed granite surfacing.

E. Base Course Installation: Comply with Greenbook Section 301-2 – “Untreated Base.”

F. Steel Edging: Install flush with stabilized decomposed granite surfacing. Provide sufficient stakes to secure in place.

3.3 INSTALLATION

A. Stabilized Decomposed Granite Paving:

1. Lines and Levels:

a. Install stabilized decomposed granite work true to grade, properly coinciding with adjacent work and elevation. Install in maximum 2" lifts.
b. Provide a finished surface uniform in texture and appearance. Do not permit finished work to vary more than 1/8 " in 10 ft. from true profile and cross section.
c. After period of +/_ 6 hours compact the final lift with a 1000 -3000 lbs static drum roller. Do not use a vibratory plate compactor or vibration function on roller as vibration separates large aggregate particles. Allow for a sufficient curing periods of +/_ 4 days prior to use.

2. Mixing:

a. General: Paving shall consist of a mixture of decomposed granite, stabilizer, thoroughly and continuously mixed with a pugg mill. A bucket mix or rototiller is not acceptable. Mix at a rate of 10 lbs. of stabilizer per ton of crushed aggregate screenings.
b. Water: Adjust quantity of water added to the mixture to permit maximum compaction of the materials after it is placed on the sub-grade. Moisture shall permeate full depth. After water application test with a minimum of one core sample per 1,000 sq. ft.; repair sample area to match adjacent section.

3. Compacting: Thoroughly compact each lift to a minimum 90 percent. Compact each area with at least 4 passes of the compacting equipment. After compacting, screed smooth. Do not use a wacker or vibratory roller to compact the D.G.

4. Contaminated Areas: Do not permit mixture to contaminate planting areas. Clean up immediately all mixtures spilled on adjacent paving.

5. Grading: When surface areas have been rolled and it becomes necessary to add a thin layer of material to bring the surface to grade, the previously rolled or compacted area shall be raked to provide a bond with the added material.

6. Finish Paving Surface: Provide a uniform texture and color and without a cement mortar film on the exposed surface. Finish surface shall not vary more than 0.02 foot from the lower edges when measured with a 10-foot straight edge. Surface shall follow overall contours of landscape. Flat areas shall be crowned for drainage. Slope min 1% to drain away from structures.

7. Curing: After installation, keep moist for a period of seven (7) days. Apply water in a fine mist or spray and in such a manner that it will not damage the finished surface.

8. Completed surface shall be of consistent quality and free of deleterious materials such as organic materials, nails, stones, and loose material. Surface shall not have depressions or humps greater than ¼ inch in ten feet.

9. Damaged or Defective Installation: Repair and replace in accordance with these Specifications at no additional cost to the client.

10. Replacement:

    a. If compression tests of samples fail to meet specified compressive strength, immediately remove and replace decomposed granite paving with material conforming to Specifications.
    b. Pay cost of all work required for removing and replacing the decomposed granite.

3.4 FIELD QUALITY CONTROL

A. Tests: For each lift, have the testing laboratory verify the degree of compaction. Recompact filed areas until specified compaction is achieved. Testing to be paid by contractor.

3.5 PROTECTION

A. Protect the paving against traffic, injury or defacement, or damage (by rain) and subsequent construction operations until Final Acceptance.

B. Do not allow traffic on stabilized decomposed granite surfacing for four days after placement or until compacted stabilized decomposed granite has fully cured.

C. Protect stabilized decomposed granite surfacing from damage until Project completion. Repair damaged areas to match specified requirements.

3.6 CLEANING

A. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

B. Loose aggregate will appear on the surface over time which is a natural occurrence. If excessive aggregate over ¼ inches occurs, redistribute the stabilized decomposed granite over the entire surface, water thoroughly and re-compact with a minimum one ton drum roller. This process can be repeated as needed.

C. To repair, excavate damaged area leaving a minimum one inch depth of existing stabilized decomposed granite, water and scarify. Scarifying existing stabilized decomposed granite will prevent a cold joint layer between the existing stabilized decomposed granite and the newly imported pre-blended stabilized decomposed granite.

D. Add water to the pre-blended stabilized decomposed granite to activate. Apply moistened pre-blended stabilized decomposed granite to excavated area at or above finished grade.

E. Compact with a walk behind drum roller. Do not allow traffic on stabilized decomposed granite surfacing for one-two days after placement or until compacted stabilized decomposed granite has fully cured.

END OF SECTION 32 15 40

SECTION 32 31 22 – PVC-CLAD CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. 8-feet high PVC Chain link perimeter fences (F-1).
2. Concrete footings for posts.
3. Manually operated swing gates.
4. Privacy slats.

B. Related work:

1. Division 03 for concrete post footings and for installation of gate track set in concrete.

1.2 SUBMITTALS

A. Data: Manufacturer product data for fabric, posts and accessories.
B. Shop drawings: Show fence layout, footing sizes and reinforcement, gate details, and typical elevations.
C. Samples:

1. Twenty-four-inch square samples of PVC coated chain link fabric.

   a. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.
   b. Provide privacy slats in the chain-link fabric sample. Include colors as called for in the Drawings.

2. Full-size sample of each type of gate hardware.

1.3 QUALITY ASSURANCE

A. The applicable provisions of the Chain Link Fence Manufacturers Institute (CLFMI) Product Manual govern the work of this Section. Size steel framework with the fabric height assumed to be 8-feet 6-inches high. Actual height is 8-feet 0-inches per drawings.
B. This requirement does not limit manufacture of the fencing components to CLFMI members.

1.4 HANDLING

A. Handle and store components to avoid damaging the finish.
B. Store off the ground in a protected location.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heavy Duty Strength Framework: Group IC, round steel pipe, electric-resistance-welded pipe produced from steel with a minimum yield strength of 45,000 psi and meeting the strength and protective coating requirements of ASTM F 1043.

B. Tubular members:

1. Type I: ASTM F 1083, Schedule 40, galvanized pipe.
2. Finish: Class 2b, coat.

a. Polymer Coated Framework: Polymer coated framework shall have a PVC coating fused and adhered to the exterior zinc coating of the post or rail. PVC coatings shall have a minimum thickness 10-mils (0.254 mm), per ASTM F1043. Color to match fabric black per ASTM F934.

C. Chain link fabric: Complying with CLFMI standards and the following with a Class 1 zinc coating weight classification.

1. One piece width, 2-inch mesh, 9-gage.
2. Knuckled edge at both selvages.
3. Fusion-bonded black PVC coating 7 to 12 mils thick, complying with ASTM F 668, Class 2B.

D. Accessories, general: Galvanized and coated with PVC matching the chain link fabric, complying with ASTM A 153, except that the coating weight may comply with the requirements of CFLMI standards for coating thickness.

1. Tension wire: 7-gage high strength steel wire.
2. Stretcher bars: One piece length equal to full height of fabric with a minimum cross section of 3/16-inch by 3/4-inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post.
3. Stretcher bar bands: Heavy pressed steel to secure stretcher bars to intermediate, corner and gate posts.
4. Post tops: Steel or malleable iron designed as a weathertight closure cap. Design caps with opening to permit passage of the top rail, when rail is provided.
5. Finish to match black vinyl PVC coating on fabric.

E. Wire ties: For tying fabric to line posts, use 11-gage steel wire clips spaced 14-inch o.c. For tying fabric to tension wire use 11-gage hog rings.

1. Finish: Painted black.

F. CONCRETE

1. Concrete for post footings shall have a 28-day compressive strength of 2,500 psi.

2.2 GATES

A. Fabricate gate frames of welded steel tubes in compliance with ASTM F 900. Provide additional horizontal and diagonal members to ensure that gates stay square and operate properly, and for attachment of fabric, hardware, and accessories.

1. All components finish to match black PVC coating on fabric.

B. Weld gate frames:

1. Use same fabric as for fencing, installed with stretcher bars at vertical edges.
2. Tie fabric to top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches o.c.
3. Attach hardware with rivets or by other means that will provide security against removal and breakage.

C. Provide manufacturer standard galvanized heavy-duty hardware.

1. For swinging gate provide the following:

a. Hinges: One pair of steel hinges, non-lift-off type offset to permit 180-degree gate opening.
b. Latch: Designed to provide operation from either side of gates and equipped with padlock eye.
c. Keeper: Designed to automatically engage and hold the leaf open until manually released.

2.3 PRIVACY SLATS

A. Tubular Polyethylene Double-walled Slats: Minimum 0.023-inch-thick tubular polyethylene, manufactured for chain-link fences from virgin polyethylene with UV inhibitor, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips.

1. Color: Redwood.
2. Direction: Run slats diagonally in chain-link mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. General: Comply with ASTM F 567 and the following.
B. Concrete footings:

1. Minimum Post footing depth: 3-feet 6-inches deep.
2. Minimum Gate footing depth: 3-feet 6-inches deep.

3. Minimum Post footing diameter: four times the largest cross section of the post up to 4.00-inches O.D.
4. Minimum Gate footing diameter: 12-inches for gate posts up to 4.00-inches O.D.
5. Top of post concrete footings to be crowed to shed water away form post.

C. Posts: Provide corner, end, and intermediate posts. Erect posts plumb and level, in straight alignment, and set in concrete footings. Support and brace until concrete sets.
D. Post cap: Provide on each post.
E. Tension wire: Install before stretching fabric and tie to each post with ties or clips.
F. Fence fabric:

1. Install within 2-inch of grade or paving on security side of fencing and on inside of tennis court and anchor to framework so that fabric remains in tension after pulling force is released.
2. Pull taut and tie to posts, rails, and tension wire.

G. Stretcher bars: Thread through fabric and secure to posts with steel bands.
H. Gates: Install plumb, level, square, free of rack and secure for full opening without interference. Adjust hardware for smooth operation.

1. Gates shall have a bottom clearance of 3 inches, grade permitting.
2. Hinge and latch offset opening space from the gate frame to the post shall be no greater than 3 inches in the closed position.
3. Double gate drop bar receivers shall be set in a concrete footing minimum 6 inches diameter 24 inches deep.
4. Gate leaf holdbacks shall be installed for all double gates.

I. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
J. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally for privacy factor of 80 to 85.

3.3 BRACING

A. Brace gates, corner, end, and pull posts to the nearest post with a horizontal brace used as a compression member and a diagonal truss rod and truss tightener used as a tension member.

3.4 TOUCHUP

A. Touchup damaged PVC coating with matching air-drying materials, when the results are acceptable to the Architect; otherwise remove and replace damaged components.

END OF SECTION

SECTION 32 32 13 UNIT MASONRY RETAINING WALLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Furnishing labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, and required for completion of the Contract; for new construction, modernization and rehabilitation projects, as applicable. Includes items such as the following:

1. Protecting existing improvements to remain.
2. Cleaning soiled improvements that are to remain.
3. Removing debris and equipment.
4. Removal of items indicated on drawings.
5. Salvageable items to be retained.
6. Delivery of salvageable items to a storage identified by Owner.

1.02 RELATED DOCUMENTS

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1. Deviations from the plans and specifications shall not be made without the written approval of the architect and/or engineer.

1.03 SUMMARY

A. This Section includes site concrete masonry unit (CMU) retaining walls, fences and enclosures.

B. Related Sections:

C. Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Division 30 Section "Earthwork" for excavation for site retaining walls.
2. Division 3 Section "Cast-in-Place Concrete" for segmental retaining wall footings.
3. Division 4 Section "Concrete Block Masonry" for decorative concrete masonry units with faces required to match site retaining wall units.

1.04 SCOPE OF WORK

A. Furnish and install concrete masonry units, mortar, grout, and masonry reinforcing steel. Provide equipment necessary for their installation.

B. Install items furnished by others: bolts, anchor bolts, angles, hinges, and built-ins.

C. Arrange for adequate bracing, forming, and shoring required in conjunction with and in the course of constructing the concrete masonry.

D. Advise the general contractor as to the position of all dowels for the masonry. The general contractor shall be responsible for the placement of all dowels in any adjoining construction.

E. Arrange for inspections.

1.05 QUALITY ASSURANCE

A. Submittals

1. Certificates of compliance with all applicable ASTM and UBC standards shall be submitted on all products specified herein.

2. Sample Specimens: Provide one sample specimen of the proposed CMU. Include color, surface treatment, and mortar color.

B. Sample Panel

1. Construct an approximate 6 feet long by 4 feet high mock-up panel for representation of completed masonry, joint tooling, design details, and workmanship.

2. Panel shall not be part of the wall system.

3. Include typical base and cap or finished top construction.

C. Inspections: Non continuous inspection allowed.

D. Tests: Owner shall pay all costs for tests.

1. Concrete masonry units per ASTM C 140.

2. Mortar per UBC Standard 21-6.

3. Grout per ASTM C 1019.

4. Prisms per UBC Standard 21-17.

1.06 PRODUCT HANDLING AND STORAGE

A. Materials of this section shall be protected to maintain quality and physical requirements.

B. All masonry units shall be stored on the jobsite so that they are protected from rain, stored off the ground and kept clean from contamination.

C. Handle units carefully to avoid breakage and damage to finished faces.

D. Glazed and ground faced masonry units shall be stored on pallets on level ground, single stacked only, and covered to protect against inclement weather. Keep protective block face covers on glazed units until installation.

PART 2 - MATERIALS

2.01 CONCRETE MASONRY UNITS

A. Load bearing concrete masonry units shall conform to UBC Standard 21-4, Grade N, and ASTM C 90. All units shall be Medium-weight, 1900 net PSI, as manufactured by Angelus Block Co., Inc. O.A.E.

1. Warm Gray Split Face OR Precision Block CMU.

2. Cool gray Split Face OR Precision Block CMU

3. Sandstone Split Face OR Precision Block CMU

Note: Item(s) indicated above may require manufacturing lead time; contact a Representative for details. Material must be ordered well in advance of anticipated masonry start.

B. Glazed masonry units shall be Astra-Glaze-SW units manufactured by Trenwyth Industries, Inc. from Angelus Block Co., Inc. or approved equal.

1. Concrete masonry unit for glazing shall be lightweight, conforming to ASTM C 90, Type I.

2. Glazed surface shall be externally heat-polymerized cast-on facing conforming to ASTM C 744.

3. Astra-Glaze Color 1: Coordinate with Architect and Owner., or

4. Astra-Glaze Color 2: Coordinate with Architect and Owner.

Note: Glazed units are special order and require manufacturing lead time.

C. Ground face masonry units with heat-treated acrylic finish shall be manufactured by Trenwyth Industries, Inc. from Angelus Block Co., Inc. or approved equal.

1. Units with factory applied, heat-treated acrylic finish shall be Trendstone units, conforming to ASTM C 744 with respect to adhesion, abrasion, color change, and resistance to crazing, and ASTM C 67 with respect to freezing and thawing.

2. Trendstone Color 1: Coordinate with Architect and Owner., or

3. Trendstone Color 2: Coordinate with Architect and Owner.

4. Units with ground surfaces filled with cementitious grout, polished, and with factory applied, heat-treated acrylic finish shall be Trendstone Plus units, conforming to all requirements of ASTM C 744, and Federal Specification SS-C-621B with respect to crazing, resistance of chemicals, adhesion, abrasion, surface burning characteristics, color and color change, soiling and cleansability, face dimensional and distortion tolerances, and ASTM C 67 with respect to freezing and thawing.

5. Trendstone Color 1: Coordinate with Architect and Owner., or

6. Trendstone Color 2: Coordinate with Architect and Owner.

Note: Ground face units are special order and require manufacturing lead time.

D. Unless otherwise specified on the plans, blocks shall be hollow, load bearing concrete units, conforming to ASTM C-90, grade 'N'. No special inspection required for masonry construction.

E. Block units shall be constructed in running bond. Architectural finish, type of block, color and top course treatment shall match those of existing fence walls.

F. Block cells shall be unobstructed and shall have vertical continuity. Cells shall be filled with grout. Maximum height of pour shall be 4 feet.

2.02 MORTAR

A. Mortar shall be Spec Mix Pre-blended Masonry Mortar, Type S, conforming to the proportion and property specifications of ASTM C 270, as manufactured by E-Z Mix Inc., Sun Valley, CA. or approved equal.

B. Mortar Materials:

1. Admixtures: Use no admixtures, air-entraining agents, plasticizers, salts, or antifreeze compounds unless specified and approved in advance by the Structural Engineer and E-Z Mix, Inc. or approved equal manufacturer.

2. Water: Use clean, potable and free of deleterious amounts of acids, alkalies or organic materials.

3. Exterior tuckpointing grout for glazed masonry units shall use Laticrete 1776 Grout Admix Plus full strength in lieu of mixing water, or approved equal.

2.03 GROUT

A. Pre-blended Grout: PRE MIX Products, Spec Concrete 30/70, 2000 PSI. minimum. Grout Mix manufactured by E-Z Mix Inc. may be used per manufacturer's specifications.

B. Grout shall conform to UBC Standard 21-19 or ASTM C 476, proportions per UBC Table 21-B.

C. Use of fine or course grout shall be per UBC Table 21-C.

D. Minimum compressive strength shall be 2000 PSI.

E. Grout shall be of fluid consistency with an 8 inch to 10 inch slump.

F. Admixtures: PRE MIX Products Grout Additive. Use per manufacturer's specifications.

2.04 REINFORCING STEEL

A. Joint Reinforcement shall conform to UBC Standard 21-10.

B. Metal Ties and Anchors shall meet the requirements of UBC Section 2102.2.7.

C. All metal reinforcement shall be free from loose rust and other matter or coatings detrimental to.

D. Reinforcing steel shall be ASTM A-615, grade 40 for smaller than #5 bars, and grade 60 for #5 and large bars.

E. Unless otherwise noted on the plans, bar splices shall be 48 bar diameter, and shall be staggered where possible.

F. Where heights of wall make impractical to have a continuous bar extending upward from the footing, a 48 diameter splice may be provided at that point.

G. Top horizontal stem bars shall be continuous through bends and corners.

H. Horizontal stem bars shall be placed from the bottom course to the maximum specified spacing. Double bars shall be provided where indicated.

I. Reinforcing bends and standard hooks shall conform to applicable code.

J. No field welding of reinforcement shall be allowed without permitting agency approval

PART 3 - EXECUTION

3.01 PREPARATION

A. Materials

1. Masonry units shall be sound, dry, and clean from all foreign matter when placed in the wall.

2. Reinforcement bars shall be free of kinks or bends, except for bends detailed in the drawings.

B. Layout and Foundation

1. All footings shall be poured against undisturbed natural soil or certified compacted fill. Any over excavation and backfill shall be inspected by the field geotechnical engineer.

2. All excavation, backfill and bearing strata shall be inspected and approved by the field geotechnical engineer.

3. Temporary shoring or another approved construction method is required for excavations, which remove the lateral support from a public way or existing structure. Separate temporary shoring approval is required.

4. Retaining portion of wall shall be drained as detailed on the plans. Swales and minors drainage devices shall be constructed per the grading and drainage plan.

5. If site conditions or layout is in any way improper, masonry work shall not begin until cleared by the governing authority.

6. Foundation shall be level and at correct grade so that the initial bed joint shall not be less than 1/4 inch nor more than 1 inch.

7. Surface of foundation shall be clean and free of deleterious materials. Surface shall be roughened to a full amplitude of 1/16 inch.

8. If a foundation dowel must be bent to align with a vertical cell, it shall not slope more than 1 inch horizontally to 6 inches vertically.

9. All footings shall be poured against undisturbed natural soil or certified compacted fill. Any over excavation and backfill shall be inspected by the field geotechnical engineer.

10. All excavation, backfill and bearing strata shall be inspected and approved by the field geotechnical engineer.

11. Temporary shoring or another approved construction method is required for excavations, which remove the lateral support from a public way or existing structure. Separate temporary shoring approval is required.

12. Retaining portion of wall shall be drained as detailed on the plans. Swales and minors drainage devices shall be constructed per the grading and drainage plan.

3.02 MIXING OF MORTAR

A. Spec Mix Pre-blended Mortar

1. Mix in a mechanical batch mixer with the minimum amount of water to produce a workable consistency.

2. Mortar may be re-tempered once to maintain plasticity and workability. Re-tempering on mortar boards shall be done by adding water within a basin formed within the mortar. Rework the mortar into the water. No mortar shall be used beyond 2 1/2 hours from the time it was originally mixed.

3.03 MIXING OF GROUT

A. Water content of the grout shall be adjusted to provide proper fluid consistency to enable placement under existing field conditions without segregation of the constituents.

B. Do not use grout more than 1 1/2 hours after initial mixing.

C. Pre-blended Grout

1. Mix in mechanical mixer until workable, but not to exceed 10 minutes.

3.04 INSTALLATION OF MASONRY UNITS

A. General

1. All masonry shall be laid true, level, plumb, and in accordance with the plans.

2. Units shall be laid in running bond unless otherwise shown on the drawings.

3. Cutting of units shall be neat, true, and made by masonry saw.

4. Concrete masonry units shall not be wetted unless otherwise approved.

5. Construction supports shall not be attached to the wall except where specifically permitted by the architect or engineer.

B. Protection

1. Extreme care shall be taken to prevent grout or mortar stains on exposed surfaces. Any mortar or grout contact shall be cleaned immediately.

2. Tops of all unsheltered walls and partially completed walls shall be covered when work is not in progress.

3.05 JOINTS

A. Mortar Joints

1. Initial bed joint shall not be less than 1/4 inch nor more than 1 inch in thickness. All cells to be filled with grout shall be kept free from mortar droppings so the grout will make full contact with the foundation.

2. Head and bed joints of hollow units shall be filled with mortar for the thickness of the face shell. Solid units shall have full head and bed joints.

3. Horizontal joint reinforcement shall be fully embedded in mortar with a minimum 5/8 inch cover between joint reinforcement and exposed face. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire diameter.

4. All mortar joints on exposed walls, unless otherwise specified, shall be concave and double struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.

5. Flush cut or sacked joints shall be used where surface is to be plastered.

6. If an installed unit is moved, it shall be removed from the wall, cleaned, and set in fresh mortar.

7. For glazed masonry units, rake back exterior mortar joints a minimum of 1/4 inch and tuckpoint with an approved water-resistant grout.

8. Tuckpoint scored joints of glazed masonry units with an approved water-resistant grout.

B. Control Joints

1. Control Joints control cracks by providing a vertical stress-relieving joint in the masonry wall while maintaining adequate shear strength for lateral wall stability.

2. Control joints shall be installed at 24 feet on center, unless noted otherwise in the drawings.

3. Control joints shall be constructed as detailed in the drawings.

4. PVC Masonry Control Joint: Use those classified by ASTM D 2287-81. The material shall meet or exceed the minimum requirements when tested in accordance with the stated test methods.

5. Synthetic Rubber Masonry Control Joint: Use those classified by ASTM D 2000-92. The material shall meet or exceed the minimum requirements when tested in accordance with the stated test methods.

3.06 INSTALLATION OF REINFORCING STEEL

A. Reinforcement shall be placed as detailed on the drawings and secured against displacement at intervals not to exceed 200 bar diameters.

B. Tolerance for placement:

1. In flexural elements shall be ± 1/2 inch for d equal to 8 inches or less, ± 1 inch for d equal to 24 inches or less but more than 8 inches, ± 1 1/4 inches for d greater than 24 inches. (d is the distance from compression face of flexural member to the centroid of tensile reinforcement.)

2. Longitudinal location shall be ± 2 inches.

C. Reinforcing bars, except joint reinforcement, shall be completely embedded in mortar or grout and have a minimum cover, including the masonry unit, of at least 3/4 inch, 1 1/2 inches when exposed to weather, and 2 inches when exposed to soil.

D. Clear distance between surface of reinforcing bar and any surface of a masonry unit shall not be less than 1/4 inch for fine grout and 1/2 inch for course grout.

1. Horizontal reinforcement bars may rest on the cross webs of hollow masonry units.

E. Reinforcing bars and wire joint reinforcement shall be lapped as indicated on the drawings.

3.07 GROUTING

A. General

1. Reinforcement bars shall be in place and secured prior to grouting.

2. All cells and areas where grout is to be placed shall be free from mortar fins greater than 1/2 inch, droppings, and foreign materials that would prevent the wall from being properly grouted.

3. Grout shall completely fill all designated spaces, and shall be confined to those spaces.

4. Segregation of grout materials and damage to the masonry shall be avoided during the grouting process.

5. Grout shall be consolidated before loss of plasticity.

a. Grout pours 12 inches or less may be puddled.

b. Grout pours greater than 12 inches shall be consolidated and reconsolidated by mechanical vibration using a low velocity vibrator with a maximum head diameter of 3/4 inch.

6. Stop grout pours 1 1/2 inches below top of wall. Where bond beams occur, stop grout a minimum of 1/2 inch below.

7. Structural masonry walls shall be solid grouted unless otherwise specified.

8. Anchor bolts shall be solidly grouted in place with 1 inch minimum of grout between the bolt and the masonry.

9. Spaces around all metal door frames and other built-in items shall be solidly grouted.

B. Low Lift Grouting

1. Grout pours shall not exceed 5 feet. Cleanouts are not required.

C. High Lift Grouting:

1. Cleanout holes shall be provided at the bottom of all cells containing vertical reinforcement in hollow unit masonry, but spaced not more than 32 inches on center.

2. Grout shall be placed in lifts not to exceed 6 feet. The full height in each wall section shall be poured in 1 day with no interruption greater than 1 hour.

3.08 WALL CLEANING AND PROTECTION

A. Minimize any mortar or grout stains on the wall during construction. Any stains that occur shall be removed immediately.

1. For burnished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge.

2. For glazed masonry units and ground face units with heat-treated acrylic finish, remove green mortar smears with a dry cloth. Do not allow mortar lumps or smears to harden on the finished surfaces.

B. The tops of all unsheltered walls and partially completed walls shall be covered when work is not in progress.

C. Where atmosphere is dry, a light fog spray may be applied to masonry surfaces for three days after construction.

D. At the conclusion of the masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site.

E. Walls of ground face units with heat-treated acrylic finish, when completed, and after final cleaning, shall receive a field coat application of Trendcoat T1 acrylic, from Trenwyth Industries, Inc., or approved equal, per manufacturer's instructions.

F. Retaining walls shall not be backfilled until materials have attained design strength.

3.09 CONSTRUCTION TOLERANCES

A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet, 3 inches maximum.

B. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.

3.010 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Comply with requirements in Division 2 Section "Earthwork" for field quality control.

1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 100 feet or less of site retaining wall length.

2. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 24 inches of fill depth and each 50 feet or less of site retaining wall length.

3.011 ADJUSTING

A. Remove and replace site retaining CMU wall construction of the following descriptions:

1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Architect approves methods and results.

2. Site retaining walls that do not match approved Samples and mockups.

3. Site retaining walls that do not comply with other requirements indicated.

B. Replace units so site retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION

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SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. Los Angeles Local Lumber: Wood that is obtained from trees located in Los Angeles County, towns or suburbs not harvested for their timber value, but removed because of insect, disease or circumstance.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Prefabrication Meeting: Conduct a prefabrication meeting 12 weeks prior to the start of the Work of this Section.

B. Required Attendance: Architect, Contractor, millwork fabricator, Los Angeles local lumber wood supplier, Owner's representative].

C. Review quality standards for use of Los Angeles local lumber wood materials, including acceptable appearance of finished material.

1.4 SUMMARY

A. Section Includes:

1. Timber Bench and Planter Guards.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves cast and installing anchor bolts cast in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Provide relevant product data for LEEDv4 and WELL rating systems credits as necessary.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.

1. Include full-size Samples of wood planter guard. Approved samples may be incorporated into the Work.

E. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

F. Spec sheet for products used and existing portfolio of work with Los Angeles local lumber.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.

1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.9 QUALITY ASSURANCE

A. 1. Los Angeles local lumber grade: ASLS PS 20 Grade; No. 1 Common or No. 2 Common

B. 2. Moisture content for construction grade lumber can be between 12-22% moisture content (MC)

PART 2 - PRODUCTS

2.1 TIMBER BENCH AND PLANTER GUARDS

A. Seat and Planter Guard

1. Material:
   a. Wood:
      1) Species: Blue Gum Eucalyptus (Eucalyptus globulus) sourced from LA county.
      2) Type of Cut: quarter-sawn & face-sawn acceptable
      3) Finish to be Modern Master MCS901 Clear MasterClear Supreme Protective Clear Coat, Matte for poly based sit on top sealer or if penetrating oil is preferred Premium Blue Label Penofin Oil.

4) The Blue Gum Eucalyptus timbers will be attached to a concrete footing using #3 rebar core drilled and embedded with epoxy into concrete and wood material.

2. Seat Height: As indicated.
3. Seat Surface Shape: Flat or Angled to shed water.
4. Overall Height: As indicated.
5. Overall Width: As indicated.
6. Overall Depth: As indicated.
7. Arms: None
8. Seating Configuration: Multiple units as indicated.
9. Provide chain of custody of harvested Los Angeles local lumber with documentation of when and where tree was removed, and when it was milled.
10. Basis of Design MFG: Angel City Lumber, 251 S. Anderson St., Los Angeles, CA 90033, (213) 373-1651

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and [securely anchored] [positioned] at locations indicated on Drawings.

D. Dowel Setting: Set cast-in anchor dowels in concrete footing with smooth top, shaped to shed water. Protect portion of anchor above footing from concrete splatter. Verify that dowels are set plumb or at correct angle and are aligned and at correct height and spacing. Hold dowels in position during placement and finishing operations until concrete is sufficiently cured.

E. Dowels Set into Voids in Concrete: Form or core-drill holes for installing dowels in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of dowel. Clean holes of loose material, insert dowels, and fill annular space between dowel and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 32 33 00

SECTION 32 33 13 – SITE BICYCLE RACKS AND LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Exterior bicycle racks.
2. Exterior bicycle lockers.
3. Accessories and installation materials.

1.2 SUBMITTALS

A. Data:

1. Manufacturer Product Data for bicycle racks and lockers, including finish. anchors, including test results for anchors in concrete.
2. Samples of sufficient size showing proposed finish on base metal.

B. Shop Drawings: At 1/8-inch scale minimum, show exact location of racks and lockers. Dimension from column lines or adjacent work.

C. Samples: Samples of sufficient size showing proposed finish on base metal.

D. Maintenance Data: For each bicycle rack.

1. Include recommended methods for repairing damage to the finish.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of bicycle racks and lockers similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing bicycle racks similar to those required for this project and with a record of successful in-service performance.

C. Source Limitations: Obtain each color, finish, shape and type of bicycle rack from a single source with resources to provide components of consistent quality in appearance and physical properties.

D. Product Options: Drawings indicate size, shape and dimensional requirements of bicycle racks and are based on the specific system indicated.

1.4 HANDLING

A. Upon delivery, before signing for shipment, inspect for any damage and notate on the Bill .of Lading.

B. Store bicycle racks in original undamaged packages and containers until ready for installation.

C. Handle bicycle racks with sufficient care to prevent any scratches or damage to the finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bike rack:

1. Provide bicycle racks manufactured by AAA Ribbon Bike Rack Co., a division of Brandir Internationals, Inc., www.ribbonrack.com.
2. Or equal.

B. Bike Lockers:

1. Provide bicycle lockers manufactured by Dura Bike Locker, a Division of Hannan Specialties Inc.
2. Or equal.

2.2 EXTERIOR BICYCLE RACKS

A. The Original Ribbon Rack.

2.3 EXTERIOR BICYCLE LOCKERS

A. Model DLSS by Dura Bike Locker, a Division of Hannan Specialties Inc. or equal
B. Size: 30-inches by 75-inches by 48-inches high.

2.4 MATERIALS

A. The Original Ribbon Bike Rack:

1. 2.375-inches OD X 0.154-inch wall thickness, schedule 40 ASTM A53/A500 hot dipped galvanized.
2. Installation Methods: In-ground mount is embedded into concrete base, as detailed.

B. Single bike lockers, surface-mounted on concrete.

1. Material:

a. G-90 galvanized steel bicycle locker.
b. Door and body: 16-gauge sheet metal.
c. Frames: 14-gauge sheet metal.
d. Perforations: Provide perforated doors and back walls.
e. Full length door hinge (ASTM A314): 16 gauge stainless steel.
f. 3-Point Locking bar Mechanism (ASTM A314): 1 inch wide by 1/4 inch thick stainless steel flat bar running beyond the full length of the door frame and into the top, threshold, and jamb (3-Points to insure Maximum Security).
g. Fasteners shall be zinc coated steel and shall be fastened from the inside.
h. Numbers: High Performance Black Vinyl Numbers.

C. Fasteners: Select anchors with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete, as determined by testing per ASTM E 488.

1. Drilled-in expansion anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion,), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade S, by Hilti, Inc., ITW Ramset/ Red Head, Star Expansion Co. or The Rawlplug Co., Inc.
2. Chemical anchors: Chem-Stud by Rawlplug Co., Inc. or HIT C-100 System by Hilti used with machine bolts complying with FS FF-B-575, Grade S.

2.5 LOCKING SYSTEM

A. Stainless steel padlock style handle (padlock not included).

2.6 FINISH

A. The Original Ribbon:

1. Hot-dipped galvanized finish after fabrication.

B. The bike lockers: Graphite

1. TGIC powder-coat.
2. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions and measurements affecting the work of this Section at site.
B. Correct detrimental conditions before proceeding with installation.

3.2 INSTALLATION

A. Bike rack:

1. In-ground mount: Install as detailed on Drawings and manufacturer’s recommendations.
2. Coordinate installation of bike racks with the work of Section 32 13 13.

B. Bike lockers:

1. Install in accordance with the manufacturer's instructions.
2. Locate where shown on drawings. Assemble and anchor in accordance with the manufacturer's instructions.
3. Set bicycle lockers secured to construction, level and true to line, in correct relationship to adjacent structure and improvements.
4. Fasteners to secure lockers to concrete shall be located inside locker.

C. Install at locations indicated on Drawings in compliance with rack manufacturer's instructions and recommendations, plumb, level and securely anchored.
D. Touchup damaged galvanized surfaces as specified in Section 05 50 00.

END OF SECTION

SECTION 32 84 00 - LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

A. All offsets, fittings, sleeves, etc. which may be required are not shown on the drawings. The Contractor shall carefully investigate the structural and finished conditions affecting the work and plan the work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification.

C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.

E. Secure the required licenses and permits including payments of charges and fees, give required notices to public authorities and verify permits secured or arrangements made by others affecting the work of this section.

1.4 SUBMITTALS

A. Water Pressure Test
1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a written verification of the existing water pressure on the project at each of the points of connection shown.
2. The water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings when water is not flowing, are not acceptable.
3. Written dynamic water pressure test confirmation shall be made on the contractor's letterhead and include the flow rate during the test, the recorded water pressure, the date of the test and the time of the test.

B. Material List:
1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
2. The submittal materials list shall include the following information:
   a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
   b. An index sheet showing the item number (e.g. 1,2,3, etc.); an item description (e.g. sprinkler head); the manufacturer's name (e.g. Hunter Industries); the item model number (e.g. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
   c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
   d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
   e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
3. Submittal materials list format requirements:
   a. Submittals shall be provided as one complete package for the project in electronic pdf format. Multiple partial submittals will not be reviewed.
   b. Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
   c. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.

C. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.

1. Provide a written statement indicating the reason for making the substitution.
2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
3. Provide in writing the difference in installed price if the item is accepted.

D. The Landscape Architect or Owner’s authorized representative will allow no substitutions without prior written acceptance

E. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

F. The Landscape Architect or Owner’s authorized representative will not review the submittal package unless provided in the format described above.

1.5 EXISTING CONDITIONS

A. Verify and be familiar with the locations, size and detail of points of connection provided as the source of water, and electrical supply connection to the irrigation system.

B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.

C. Prior to cutting into the soil, locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.

D. Protect all existing utilities and features to remain on and adjacent to the project site during construction. Repair, at its own cost, all damage resulting from his operations or negligence.

E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.

F. Verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.

G. Protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.

H. Notify Owner’s Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.

I. Repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner’s Representative.

J. Provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by

Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at www.bulletmole.com). Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

1.6 INSPECTIONS

A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.

B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.

C. Inspections will be required for the following at a minimum:
1. Pre-construction meeting.
2. System layout.
3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
4. Coverage test of irrigation system. Test shall be performed prior to any planting.
5. Final inspection prior to start of maintenance period.
6. Final acceptance prior to turnover.

D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.

E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to Owner.

1.7 STORAGE AND HANDLING

A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.

B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. Remove and dispose of rubbish and debris at frequent intervals or when ordered to do so by the Owner's authorized representative.

B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

A. Record Drawings:
1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
2. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.
3. All record drawings shall be prepared using AutoCAD 2020 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or Owner's authorized representative.
4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or Owner's authorized representative. After acceptance by the Landscape Architect, City Inspector or Owner's authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2020 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
   a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
   b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
6. Show locations and depths of the following items:
   a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
   b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
   c. Isolation valves
   d. Automatic remote control valves (indicate station number and size)
   e. Quick coupling valves
   f. Drip air relief and flush valves
   g. Routing of control wires where separate from irrigation mainline
   h. Irrigation controllers (indicate controller number and station count)
   i. Related equipment (as may be directed)

B. Controller Charts:
1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.

2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

C. Operation and Maintenance Manuals:
1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
   a. Operating and maintenance instructions for all equipment.
   b. Spare parts lists and related manufacturer information for all equipment.

D. Equipment:
1. Supply as a part of this contract the following items:
   a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
   b. Three 30-inch sprinkler keys for manual operation of control valves.
   c. Two keys for each automatic controller.
   d. One valve box cover key or wrench.
   e. Six extra sprinkler heads of each size and type.
   f. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

1.10 COMPLETION

A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or Owner’s authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.

B. The Owner's authorized representative shall have final authority on all portions of the work.

C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.

D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the Owner's satisfaction by the Contractor without any additional expense to the Owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 GUARANTEE

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

B. Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owner by the Contractor, all at no additional cost to the Owner.

C. Guarantee shall be submitted on Contractors own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:
PROJECT LOCATION:

CONTRACTOR NAME:
ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - MATERIALS

2.1 SUMMARY

A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

2.2 PIPE

A. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.

B. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.3 METAL PIPE AND FITTINGS

A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.

B. Fittings shall be medium brass, screwed 125-pound class.

C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

2.4 PLASTIC PIPE AND FITTINGS

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40 and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

2.5 VALVES

A. Ball Valves:
   1. Ball valves shall be of the manufacturer, size, and type indicated on the drawings.
   2. Ball valves shall be constructed of a bronze or stainless steel body, stainless steel ball and stem. Ball valves shall have threaded connections.

3. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
4.

B. Automatic Control Valves:
1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Provide Christy's valve ID tags for each remote control valve with valve number.

2.6 AUTOMATIC CONTROLLER

A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.

B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.

C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.7 ELECTRICAL

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

2.8 LOW VOLTAGE CONTROL WIRING

A. Remote control wire shall be 14 gauge AWG THHN/THWN.

B. Connections shall of the manufacturer, size, and type indicated on the drawings.

C. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).

D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.9 IRRIGATION HEADS, DRIP EMITTERS, AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters, and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.

B. Irrigation heads, drip emitters, and inline drip tubing shall be used as indicated on the drawings.

2.10 DRIP IRRIGATION EQUIPMENT

A. Drip tubing equipment such as flush valves, wye strainers, and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

B.

2.11 MISCELLANEOUS EQUIPMENT

A. Equipment such as flow sensors, rain sensors, flush valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Inspections:
   1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
   2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:
   1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
   2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:
   1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
   2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
   3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.

E. Diagrammatic Intent:
   1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.

F. Layout:
   1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
   2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply:
   1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.

H. Electrical Service:
   1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
   2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
   3. Contractor shall make electrical connections to the irrigation controller.

3.2 TRENCHING

A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.

B. Provide minimum cover of 12 inches for non-pressure lines.

C. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

3.3 BACKFILLING

A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.

B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

C. Flooding in lieu of tamping is not allowed.

D. Under no circumstances shall truck wheels be used to compact backfill.

E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

3.4 PIPING

A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.

B. Cutting or breaking of existing pavement is not permitted.

C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.

D. Remove all dented and damaged pipe sections.

E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.

F. Parallel lines shall not be installed directly over each other.

G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess

solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.

I. Center load all plastic pipe prior to pressure testing.

J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.

K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope an all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic male adapters.

3.5 CONTROLLER

A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.

B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.

C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

3.6 CONTROL WIRING

A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.

B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.

C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.

D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.

E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.

3.7 VALVES

A. Automatic control valves, quick coupler, and ball valves are to be installed in the approximate locations indicated on the drawings.

B. Provide valve ID tags for each remote control valve with valve number.

3.8 IRRIGATION HEADS, DRIP EMITTERS, AND INLINE DRIP TUBING

A. Irrigation heads, drip emitters, and inline drip tubing shall be installed as indicated on the drawings.

B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.

C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

3.9 MISCELLANEOUS EQUIPMENT

A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.

B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.

C. Install devices such as rain sensors, flush valves, master valves, and flow sensors as indicated on the drawings and as recommended by the manufacturer.

3.10 FLUSHING THE SYSTEM

A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.

B. Irrigation heads shall be installed after flushing the system has been completed.

3.11 ADJUSTING THE SYSTEM

A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.

B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.

C. The entire system shall be operating properly before any planting operations commence.

D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters and inline drip tubing operate at the pressure recommended by the manufacturer.

3.12 TESTING AND OBSERVATION

A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and governing agencies.

B. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.

C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.

D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.

E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, Owner, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.

F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the contractor at no additional cost to the owner.

G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

3.13 MAINTENANCE

A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.14 COMPLETION CLEANING

A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 32 90 35 - LANDSCAPE MAINTENANCE

PART 1- GENERAL

1.1 GENERAL CONDITIONS

A. The Conditions of the Contract and Division 1 apply to this section as fully as if repeated herein.

1.2 SUMMARY

A. Services, equipment, materials and facilities required for the care and maintenance of landscaping including all plants and irrigation.

B. Maintenance to include: watering, fertilization, mowing and edging of turf, trimming and pruning of trees, pruning and hedging of shrubs, cultivation of beds, weed control, pest control, adjustment and minor repair of irrigation and clean-up, pruning for maintenance of tree growth on structure.

1.3 RELATED SECTIONS

A. Landscape Planting- Section 32 90 00

B. Irrigation- Section 32 80 00

C. Palm Planting- Section 32 90 31

1.4 REFERENCES

A. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices; 2001.

B. ANSI Z133.1 - American National Standard For Arboricultural Operations - Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush - Safety Requirements; 2006.

C. ASTM D 4972 - Standard Test Method for pH of Soils; 2001.

D. International Society of Arboriculture (ISA), 'Best Management Practices for Tree Pruning'.

E. Standardized Plant Names, established by Hortus III.

F. Handbook 60 USDA (USA Standards).

G. USC Soils Fertility Standards (USA Standards).

H. New Century Project -Landscape Maintenance Plan Guide (In development, to be issued by Landscape Architect at start of Maintenance period)

1.5 MAINTENANCE PERIOD

A. Complete landscape maintenance to be provided for a period of (90) calendar days. Maintenance period to commence immediately after completion of all punch list items and written acceptance of installation issued by Landscape Architect

1.6 SUBMITTALS AND COORDINATION

A. In accord with Section 01330 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets for fertilizer, herbicide, pesticide, and other chemical materials to be used, showing trade name, chemical composition and mixing handling and application instructions.

C. Maintenance and Operations schedule:

1. Anticipated number of workers, work hours and scheduled days.
2. Fertilization Program; based on agronomic soils report.
3. Weed Removal and Abatement Program; including methods, and materials to be used.
4. Erosion Control Plan: indicating action and measures to be taken during heavy rain. This work may include but is not limited to; silt control at drain inlets, sandbags along swales and hardscape, and silt barriers or fences on slopes to control erosion.

D. Site Reports: To be submitted on a monthly basis. Prepare written report documenting each week’s activities, include the following;

1. Date, time, and general description of weather.
2. Landscape services provided.
3. Irrigation maintenance performed and watering schedule.
4. Diagnosis and treatment of any unhealthy plants.
5. Removal of dead plants, including quantity, type, size and location.
6. Pesticide applications, including type and area of application.
7. Herbicide applications, including type and area of application.
8. Replacement plant material, including quantity, type, size and location.

E. List of key personnel who will be responsible for planting and irrigation maintenance activities, including 24 hr.-7 day emergency contact numbers.

1.7 QUALITY ASSURANCE

A. In accord with Section 01440, Quality Assurance and Quality Control.

B. Workman Qualifications:

1. Contractor to be licensed by the State of California and a member in good standing of the California Landscape Contractors Association (CLCA).
2. Contractor and on-site supervisor shall have no less than 5 years of documented experience successfully maintaining planting and irrigation similar to the scope and complexity of this project.
3. All on-site workers shall comply with instructions and requirements pertaining to conduct and property regulations enforced by Owner.
4. Contractor shall provide uniforms or other Owner approved method of Identification for all on-site personnel.
5. A Certified Arborist shall be present to direct all tree pruning operations as approved by Landscape Architect.

1.8 PRE-JOB CONFERENCE

A. At least two (2) weeks prior to the commencement of work, conduct an on-site review of the existing landscape with the Landscape Architect. This meeting shall include all parties responsible for scheduling, performing and supervising the work.

B. Review methods and procedures related to the work of this Section, including, but not necessarily limited to the following:

1. Review of required submittals for all products to be used. .
2. Schedule and sequencing of work.
3. Coordination with existing site conditions and Theme Park operations.
4. Owner's intended appearance and character to maintained for plants and planting areas.
5. Review New Century Project -Landscape Maintenance Plan Guide (In development, to be issued by Landscape Architect at start of Maintenance period)
6. Required inspections, reviews and procedures for approvals.

C. Maintenance Design Manual and Guidelines: Prior to preceding with the work review with the Landscape Architect each Block area for specific maintenance direction and design intent guidelines.

PART 2- PRODUCTS

2.1 EQUIPMENT

A. Furnish and adequately maintain equipment in sufficient quantity to properly carry out all required work.

B. On-site storage facilities will not be provided. Unless specific arrangements are made in advance with Owner, equipment and materials will not be allowed to be stored on-site.

2.2 MATERIALS

A. Plants:

1. All plant material required for replacement purposes shall be of the same genus, species, cultivar, size and character as the original.
2. Selection, delivery and approval of replacement plants shall be subject to all requirements of Section 329000 - Planting.

B. Mulch: Match material type, size and vendor as used on original installation.

C. Amendments: Match material type and mix ratios as used on the original installation.

PART 3- EXECUTION

3.1 GENERAL

A. Maintain all plant material in a manner that promotes good health, growth and appearance.

B. Maintain all planting areas in a neat and clean condition, free from of all weeds and debris.

C. Replace all dead, dying, and damaged plant material in a prompt and expedient manner.

D. Operate and maintain irrigation system to provide efficient and effective use of water.

E. Remove all weeds.

F. Clean up operations are to be done on a weekly basis or as directed by the Owner

3.2 IRRIGATION

A. Adjust station run times as required to adequately and efficiently water all planting areas.

B. Maintain and adjust spray heads to control overspray and provide proper coverage.

C. Repair or replace damaged or broken spray heads and nozzles as needed.

D. With use of a soil probe, verify depth and quantity of moisture in tree root balls and adjust system as needed to maintain optimum moisture conditions.

E. Provide supplemental hand watering if required during plant establishment period.

3.3 EROSION CONTROL

A. Comply with federal, state and local regulations required to mitigate storm water run-off and control sedimentation from entering storm drains.

B. All Erosion Control measures to comply with the project Storm Water Pollution Prevention Plan (SWPPP).

C. Repair temporary erosion control measures in-place as needed.

D. Add additional temporary erosion control as required to prevent erosion and run off.

E. Repair eroded areas and replant as needed when caused by excessive storm events.

3.4 PEST CONTROL APPLICATIONS

A. All plant material shall be closely monitored for insect and disease problems. When a problem is found, the first attempt to control pests, diseases and any unwanted species of plant or animal will be using Integrated Pest Management (IPM) techniques.

B. As a secondary measure, after approval of owner insecticides, pesticides, herbicides shall be applied on a controlled basis under the direction of a California Licensed Pesticide Applicator.

C. Perform work in accord with all applicable laws, codes, and regulations including licensing and training requirements for applicators.

D. Notify Owner 24 hours in advance of all pesticide and herbicide applications.

E. Application methods used shall prevent contamination of areas outside the target area and should not be performed during inclement weather.

3.5 PLANTING MAINTENANCE

A. Turf:

1. Mow and edge all turf areas to uniform height on a regular weekly schedule.
2. Alternate mowing pattern to avoid rutting. No mowing should be performed under wet or overly saturated conditions.
3. De-thatch and fertilize in a manner that produces healthy and uniform growth.
4. Mechanically aerate when and where needed to reduce compaction and increase water penetration.
5. Set mowing height as recommended by supplier and approved by Landscape Architect.

B. Ground Cover, Vines and Espaliers:

1. Trim groundcovers to encourage dense, well-developed growth covering intended areas.
2. Do not allow climbing, twining, or creeping plants to encroach into other species.
3. Extend and attach new growth of vines to trellis or walls as appropriate with approved vine ties.
4. Prune and tie espaliered plants to supports to encourage desired branch form.
5. Flowering Plants: Dead-head all flower beds to encourage new growth.

C. Trees:

1. Typical Pruning of evergreen and deciduous trees shall be limited to removal of dead or broken branches and minor trimming to maintain shape or size to meet the Landscape Architects design intent.
2. Palms shall have dead fronds removed on a regular basis or as needed for safety reasons.
3. No major pruning shall be done without prior approval and direction from Landscape Architect.
4. Adjust stakes, guys and bracing as needed to provide proper support for trees and to avoid girdling.

D. Shrubs and Hedges:

1. Hand prune shrubs to balance form and shape according to plants natural growth habits.
2. Remove water shoots, suckers, and branches not conforming to desired shape and size.
3. Pinch or prune terminal buds to promote fuller growth.
4. Clip formal hedges to control growth and retain desired shapes.
5. Plant Material Replacement: Replace all dead or dying plant material suppliers to the project at the existing size as determined by the Landscape Architect as part of the warranty program. Materials damaged beyond the contractors responsibility or vandalism to be brought to the attention of the owner with associated repair and replacement cost.

E Maintenance Fertilization:

1. Apply Yara's Turf Royale 21-7-14 at 5 pounds per 1,000 square feet once every 3 months or as noted in the soils test results.
2. Monitor the site with periodic soil and plant tissue testing.
3.. The above is for bid basis and may be adjusted based on specific final grades and soils testing.

3.6 CLEAN-UP AND PROTECTION

A. Exercise care during the performance of all maintenance operations and protect existing facilities, structures and adjacent planting areas from damage.

B. Provide protection under all equipment and vehicles brought on site to avoid contamination of hardscape surfaces.

C. Remove debris from all landscape areas at least once a week. Debris consists of trash, rubbish, dropped leaves, downed branches and limbs of all sizes, dead vegetation, and any other material not belonging in landscape.

D. Refresh mulch to maintain specified depths and provide even coverage

E. Clean hardscape and pavement of all dirt and debris generated by maintenance activities.

F. Remove all clippings, trash and debris from site and dispose of properly.

END OF SECTION 329035

SECTION 32 90 00 - LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The Condition of the contract and Division 1 apply to this section as fully as if repeated herein.

1.2 SUMMARY

A. Work Specified in this Section: Furnish all labor, material, equipment and service necessary to provide all landscape planting, complete and in place, as shown and specified herein, including soil preparation, planting, seeding, staking, guying, and clean-up.

B. Related Work Specified in other Sections:

1. Irrigation - Section 32 84 00
2. Landscape Maintenance - Section 32 90 35

1.3 REFERENCES:

1. "American Standard for Nursery Stock", ANSI Z60.1-2004 -Approved May 12, 2004, American Association of Nurserymen, Inc.
2. "Hortus III", 1976 Edition, Bailey Hortorium, Cornell University.

1.4 SUBMITTALS

A. Plant Materials

1. Submit documentation to the Landscape Architect within sixty calendar days after award of Contract that all plant material is available and sources and suppliers have been identified. At that time include schedule of nursery review visits anticipated to allow all materials to be approved six month prior to installation. In addition, all 24” boxed material and larger will be tagged and approved by Landscape Architect 120 days after award of Contract. The Contractor shall be responsible for all material listed on plant list. If plant material or container size specified in plant schedule is not available Contractor is to provide method for contract growing. All materials shall be subject to observation by the Landscape Architect at any time after confirmation of ordering.

2. Plants shall be subject to observation and preliminary acceptance by the Landscape Architect at place of growth or upon delivery for compliance with these specifications.

3. Such observation shall not impair the right of observation and rejection during progress of the work. Tagging or approval of plant material is for design intent only and does not constitute the Landscape Architects approval of the plant materials in regards to their health and vigor. The health and vigor of the plant materials is the sole responsibility of the Contractor. Submit written request for observation of plant material at place of growth to the Landscape Architect. Written request shall state the place of growth and quantity of plants to be observed. The Landscape Architect reserves the right to refuse

observation at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

4. Prior to approving plant materials, the Contractor shall submit color photos of plant materials as indicated on the drawings, labeled with source, height, spread, and caliper. Upon approval of photos, trees will be inspected at the nursery source. Shrubs, vines, groundcovers may be reviewed at the nursery source or on site as determined by the Landscape Architect.

5. For contract-grown materials contractor shall submit contract growing nursery's name to the Landscape Architect for approval prior to start of contract growing activity. It shall be the Contractor's responsibility to coordinate any contract growing activities so as to meet the approved construction schedule requirements. All cost associated with contract growing shall be the Contractor's responsibility.

B. Samples:

1. Organic and Inorganic Mulch: One (1) lb each type, size, color

2. Soil Mix: One (1) pound each type.

C. Shop Drawings:

a. Foam Weight Reducer- provide drawings indicated proposed locations, layout, sizing (LxWxH) of installation.

D. Materials and Products:

1. Provide four copies of manufacturer’s specifications and catalog cuts of all specified products for approval, including but not limited to all agricultural amendments, turf seed, tree staking and guying materials, anti-desiccant, root barrier, vine attachments, and filter fabric.

2. Owner will provide base line agronomic soils test from existing on site planting soils for bid purposes only. Contact Landscape Architect for copies of Wallace Laboratories, LLC testing data. Prior to planting operations provide additional Agronomic soils samples and report for soil suitability and fertility with written recommendations for Landscape Architects approval. Samples and report to include:

a. Import Topsoils- Prior to import operations provide initial samples and additional samples as required by Wallace Laboratory to indicate approval for use.

b. All soils testing for planting areas and import soils to be tested by: Wallace Laboratory 365 Coral Circle, El Segundo, CA 90245 – Phone 310-615-0116.

c. Contractor to pay for all planter soil testing required.

3. Provide environmentally sound weed control program to maintain the site weed free including schedule, methods and materials to be used as approved by California Licensed Pest control advisor. Submit three copies of written Weed Management Program to Landscape Architect for approval prior to commencement of soil handling and planting operations.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Contractor to be licensed for Landscape and Irrigation Contracting by the State of California for a minimum of 5 years.

2. Landscape installer who maintains and experienced full-time supervisor on project site when exterior planting is in progress.

B. All plant materials shall be tagged, and/or selected and approved by Landscape Architect three (3) months prior to installation.

C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, “American Standards for Nursery Stock.” 75% of plants purchased must be from Nurseries which adhere to Sustainable Practices in Plant Production.

D. Provide an onsite area, approved by the Landscape Architect, that will be used to prepare all on site Mock Ups to include but not limited to Soil preparation, tree planting, tree staking and guying, finished grading, shrub planting, groundcover planting, turf and mulch installation. The approved site mock up will become the basis of the site quality control and approvals. Any changes to the agreed and approved Mock Up sample must be done in writing.

E. Required observations are listed below. Notify Landscape Architect 72 hours in advance to schedule the following approvals/inspections:

1. Materials:

a. All plant materials shall be observed and approved by the Landscape Architect, for specified size, quality, and variety, prior to commencement of planting operations. Such approval shall not impair the right of observation and rejection during the progress of work for size and condition of root ball or root mass, latent effects, diseases, pests or injuries.

b. A maximum of two observations for approval of plant material will be made by the Landscape Architect. For the first observation, the Contractor shall present not less than 50% of the total of required plant material. The Contractor shall submit the remainder at the second observation.

c. If any defective or non-complying plants are found during observations, they will be rejected and replaced at no cost to owner.

d. All rejected plant material shall be removed from the site no later than a minimum of two working days from notification.

e. The Landscape Architect reserves the right to take and analyze samples of materials for compliance with these specifications at any time. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of testing of materials not meeting these specifications shall be paid by Contractor.

2. Workmanship: Observation of site at critical stages of work.

a. Observation of soil separator on structure prior to installation of soil if required.

b. Observation for approval of landscape finish grading and soil preparation before installation of plant material:

(1) During this observation the Landscape Architect may request that samples of the prepared soil be analyzed by an approved laboratory to assure its compliance with specifications.

(2) Notification of exception shall be for the Contractor to correct deficiencies in the soil preparation to render it in compliance with these specifications. Corrections shall be made prior to any planting, or, at the Landscape Architect's option, the installation of trees may proceed if the corrections can be made later without affecting the quality of the work. The Contractor shall notify the Landscape Architect in writing when the deficiencies have been corrected.

c. Observation of planting installation.

d. Observation of tree staking.

e. Observation by the Landscape Architect will be made at substantial completion of all materials, construction and installation work required by the Contract prior to commencement of the plant establishment period. The plant establishment period shall not commence until all deficiencies found from this observation have been corrected and written notice of start of commencement has been received from the Landscape Architect. All materials shall be installed prior to this observation with the following exceptions:

(1) Items waived by the Landscape Architect for this observation for reasons of substantiated unavailability, or in appropriate season or weather.

(2) Items which do not affect the health or growth of the plantings.

F. Certifications:

1. Submit a certificate of delivery slip with each delivery of material in containers or in bulk. Certificates shall state source, quantity, or weight, type and analysis and date of delivery. Materials which are not pre-packaged shall have analysis completed by an approved independent testing laboratory (see plans). Deliver all certificates to the Landscape Architect prior to installation, incorporation or application of the material.

a. Quantities of fertilizer.

b. Quantities of soil amendments.

c. Quantities of mulch.

G. Protection and temporary erosion control.

1. Protect all existing sub drainage systems in place. Repair or replace any damaged systems caused by planting operations as approved by the Landscape Architect.

2. Maintain all existing tree protection in place until authorized for removal.

3. Maintain temporary fences and barriers to limit access to planting areas from vehicular and pedestrian compaction.

4. As required provide and maintain silt fences and sand bags to eliminate site erosion and offset mud and debris run off during planting operations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade mark, and compliance with all applicable laws.

2. Deliver exterior plants after preparations for planting have been completed and install immediately.

3. Deliver all plant blocks and trees with legible identification labels.

   a. State correct plant name and size indicated on plant list.

   b. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 calendar days.

4. Protect plant material during delivery to prevent damage to root ball, trunk, crown, branches, leaves, and fronds. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not prune trees and shrubs before delivery. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape.

5. The Contractor shall notify the Landscape Architect fourteen (14) calendar days in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.

6. Coordinate all deliveries with supplier, and with construction schedules. Provide adequate labor and experienced personnel, and equipment to handle off loading, storage and handling of plant material.

7. Maintain ongoing record of all plant materials delivered to site and materials that have not been received for Landscape Architect’s review.

B. Storage:

1. Store plant material in area approved by Landscape Architect. Provide shade covering if required by plant material species. Protect all plant material from weather extremes. Allow stored material adequate space for air circulation, and to prevent damage.

2. Do not deliver more material on site than can be planted, stored, secured or maintained on a weekly basis.

3. Maintain and protect plant material not to be planted within four (4) hours in a healthy, vigorous condition.

4. Provide ongoing watering to all plant material delivered to the site. Maintain all plant material with moist root balls.

5. All plant materials in temporary holding areas to be provided with water source to allow either hand watering or automatic irrigation watering systems.

C. Handling: The Contractor shall exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and if installed, shall be replaced with undamaged materials at the Contractor's expense.

1.7 PROJECT CONDITIONS

A. Perform actual planting only when weather and soil conditions are suitable and will not be detrimental to the plant material.

1.8 SCHEDULING

A. Prior to commencement of landscaping work, the Contractor shall arrange a conference at the site with the Landscape Architect. The conference shall include the Contractor, the Superintendent appointed to oversee the work of this Section and the Landscape Architect. At least twelve (12) working days notice shall be given prior to the conference. The Contractor shall prepare a schedule of work items by landscape zone, and work sequence shall be reviewed at the conference.

B. Do not install plant materials prior to acceptance of finish grades (and main line trenching/installation of irrigation system).

C. Sequencing: Coordinate with work of other sections to insure the following sequence of events:

1. General: Irrigation system to be installed and operable prior to installation of plant materials. Schedule hand watering of all plant materials installed prior to sprinkler irrigation system.
1. Plants in Pots: Schedule delivery of plants to coincide with installation of pots as determined by Landscape Architect.
2. Filter fabric (for on-structure planters): Cover bottom of planter with Filter Fabric. Continue up sides of planter per drawings.
3. Headers: Install prior to installation of adjacent irrigation system.
4. Vines: Do not attach anchors or ties to wall or other structures prior to acceptance of such work under another Section.
5. Trees in Paving: As necessary, install prior to installation of paving under another Section.
6. Pruning: Do not prune plant materials prior to installation and acceptance. Request review by Landscape Architect prior to pruning.

D. The following are the key planting reviews to be scheduled with the Landscape Architect for approval of the installation. Notify Landscape Architect 72 hours in advance to schedule the following approvals/inspections.

7. Historic Tree transplanting
8. Tree planting installation prior to shrub planting.
9. Tree staking and guying.

10. Finished grading and drainage prior to shrub planting to insure all flow lines to inlets are established.
11. Irrigation coverage test prior to shrub planting.
12. Weed control prior to shrub, ground cover and turf planting.
13. Shrub layout and planting.
14. Finished grading and establishment of all drainage flow lines.
15. Turf and Ground cover layout.
16. Mulch installation. (In some cases mulch may be applied prior to groundcover installation if grading is approved).
17. Final tree and shrub pruning
18. Final irrigation installation review.
19. Final acceptance of the work.

1.9 WARRANTY

A. All plant material installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship. Guarantee all trees and palms for one year and all shrubs and groundcover 90 days from the project completion date and final acceptance of the work.

1.10 GENERAL REQUIREMENTS

A. Work shall meet the requirements of all governing codes, ordinances, laws, regulations, safety orders and directives, including LEED requirements etc. relating to the work.

B. Quantities given for plant materials specified for “on center” spacing are shown for convenience only and are subordinate to the space given. Check and supply sufficient number of plants to fulfill spacing requirements.

C. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both.

PART 1 - PART 2 – PRODUCTS

2.1 MATERIALS

A. The following soil amendments and fertilizers are to be used for bid price basis only. Specific amendments and fertilizer specifications will be made prior to planting operations.

B. All materials shall be of standard approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Landscape Architect with a sample of all supplied materials within fourteen (14) days after award of contract, accompanied by analytical data from an approved laboratory source or bearing the manufacturer's guaranteed analysis. Amendments may be modified based on analysis provided.

C. Organic Amendment:

Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat moss, etc., low in salts and heavy metals, free from weed seeds, pathogens and other deleterious materials as approved by agronomic soils report.
The compost shall be aerobic without malodorous presence of decomposition products. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 Screen.

1. Humus material with an ash content of not less than 6% and not more than 20%.
2. The pH shall be between 6 and 7.5.
3. Salt content shall be less than 10 milliohm/cm at 25°C (Ece less than 10) in a saturated paste extract. The maximum rate of application shall not exceed 15% by volume unless the salinity is lower than 10 milliohm/cm at 25°C.
4. Boron content of the saturated extract shall be less than 1.0 parts per million.
5. Silicon content (acid-insoluble ash) shall be less than 50%.
6. Calcium carbonate shall not be present if applied on alkaline soils.
7. Carbon: nitrogen ratio shall be less than 20:1.
8. Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic ___20
copper____150
selenium__30
cadmium__15
lead_____100
silver_____10
chromium__100
mercury___10
vanadium__200
cobalt____50
molybdenum__20
zinc___200
nickel_____100

9. Approved organic amendments and suppliers include;

   a. Composted & Washed Steer Manure, as supplied by Earth Works, Tel: (909) 270-0088
   b. Hydro Blend, as supplied by Aguinaga Fertilizer Co., Tel: (949) 786-9558.
   c. Peat: Milled Canadian Sphagnum peat; light brown and fibrous without excessive sticks, with a pH of 4 to 6 or Owner-approved equivalent.

D. Soil Amendments: provide as required per results of agronomic soils tests.

1. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99% sulfur (expressed as elemental).
2. Iron Sulfate: 20% Iron (expressed as metallic iron), derived from ferric and ferrous sulfate, 10% sulfur (expressed as elemental).
3. Calcium Carbonate Lime: 95% lime as derived from oyster shells.
4. Gypsum: Agricultural grade product containing 98% minimum calcium sulfate.
5. Dolamite Lime:
   21% calcium
   11% magnesium

E. Fertilizer:

1. Planting Fertilizer: Pelleted or granular form shall consist of the following percents by weight and shall be mixed by commercial fertilizer supplier:
   6% nitrogen
   20% phosphoric acid
   20% potash

F. Imported Topsoil: weight not to exceed 105 pounds per cubic foot saturated

1. General - Topsoil shall be free of roots, clods, and stones larger than 1-inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.

2. Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil.

3. Gradation limits - soil shall be a sandy loam, loam, or clay loam. The definition of soil texture shall be the USDA classification scheme. Gravel over ¼-inch in diameter shall be less than 20% by weight.

4. Permeability Rate - Hydraulic conductivity rate shall be not less than one inch per hour or more than 20 inches per hour when tested in accordance with the USDA Handbook Number 60, method 34b or other approved methods.

5. Fertility – The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/DTPA Extraction
parts per million (mg/kilogram)
dry weight basis

phosphorus	2 - 40
potassium	40 - 220
iron	2 - 35
manganese	0.3 - 6
zinc	0.6 - 8
copper	0.1 - 5
boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 2

6. Soil may need to be amended and conditioned to optimize plant growth. The above listed fertility is for soil selection. Concentration of nutrients for final acceptance

Ammonium Bicarbonate/DTPA Extraction
parts per million (mg/kilogram)
dry weight basis

phosphorus	10 - 40
potassium	100 - 220
iron	24- 35
manganese	0.6 - 6
zinc	1 - 8
copper	0.3 - 5

boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 2

7. Acidity - The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 - 7.9.

8. Salinity - The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 0.5 - 2.5 dS/m.

9. Chloride - The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

10. Boron - The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

11. Sodium Adsorption Ratio (SAR) - The maximum SAR shall be 3 measured per Method 20b, USDA Handbook. Number 60.

12. Aluminum – Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 3 parts per million.

13. Soil Organic Matter Content - Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter. The desirable range is 3% to 5%. The carbon nitrogen ratio should be about 10. A high carbon nitrogen ratio can indicate the presence of hydrocarbons or non-humified organic matter.

14. Calcium Carbonate Content - Free calcium carbonate (limestone) shall not be present for acid-loving plants.

15. Heavy Metals - The maximum permissible elemental concentration in the soil shall not exceed the following concentrations:

Ammonium Bicarbonate/DTPA Extraction
parts per million (mg/kilogram)
dry weight basis

arsenic	1
cadmium	1
chromium	10
cobalt	2
lead	30
mercury	1
nickel	5
selenium	3
silver	0.5
vanadium	3

If the soil pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible

elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

16. Phytotoxic constituent, herbicides, hydrocarbons etc. - Germination and growth of monocots and dicots shall not be restricted more than 10% compared to the reference soil. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Methods No. 8020.

17. Weight: Not to exceed 105 pounds per cubic foot saturated.

G. Herbicide:

1. As approved by California Certified Pest Control Advisor with products that are certified eco-friendly.

H. Plant Material:

1. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, plant diseases, and sunscalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well 'hardened' systems and vigorous and fibrous root systems which are not root or pot-bound. In case the sample plants inspected are found to be defective, the Architect reserves the right to reject the entire lot or lots of plants represented by the defective samples. Any plants rendered unsuitable for planting because of this inspection shall be considered as samples and shall be provided at the expense of the Contractor.

2. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall comply with the measurements, if any, specified on the drawings in the list of plants to be furnished. Plants larger in size than specified may be used with the approval of the Landscape Architect, but the use of larger plants shall not change the contract price.

3. Contractor to verify that all container stock (excluding annuals) to has been grown in the containers in which delivered for at least one growing season, but not over two (2) years.

   a. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project.

   b. Appearance: Trees shall be exceptionally heavy, symmetrical, tightly knit, and so trained or favored in development and appearance as to be superior in form for their species, with regard to number of branches, compactness and symmetry.

4. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.

5. Condition of Root System: Provide quantities of plant materials as shown on Drawings for destructive inspection by Landscape Architect. Samples must prove to be free of kinked, circling or girdling trunk surface and center roots and with no evidence of a pot-bound condition. Upon inspection by Landscape Architect at the job site, if five (5) percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species will be rejected.

6. Measurements:

   a. General: Take caliper measurement at a point on the trunk 6 in. above natural ground line for trees up to 4 in. in caliper (and at a point 12 in. above the natural ground line for trees over 4 in. in caliper.)

      (1) Measure foliage across mean foliage dimension when branches are in their normal upright position. Foliage origin along main trunk shall be measured from soil line.

      (2) Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.

   b. Size Range: If a range of size is given, do not use plant materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

7. Unacceptable Trees: Trees which have damaged or crooked leaders, will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused, will be rejected.

8. Field Dug Stock: Prior to digging of field grown plant materials, insure that excess loose fill resulting from cultivation around stems and over roots be removed down to natural finish grade at crown of plant materials. During digging, verify that size of tree spade or other equipment is adequate to encompass the actively-growing root zone of all plants. Plants which, after digging, show mostly large fleshy roots and fibrous roots will be rejected.

9. All plants not in compliance with the requirements herein specified, will be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein or as shown on the drawings. Under no conditions shall there be any substitutions of plants or sizes listed on the accompanying plans, except with the express consent of the Landscape Architect.

10. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the Landscape Architect.

11. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book" (current edition).

12. B&B plants: Dig B&B plants with firm, natural balls of earth of diameter not less than that recommended by USDA Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. B&B material are to be wrapped with organic wrapping burlap only. Synthetic material will not be accepted. Wrap and tie as required to prevent all cracking or loss of soil from rootball.

I. Guying and Staking Materials:

1. Staking: For all trees 48” box and smaller.

a. Wood Tree Stakes: Lodge pole pine fully treated with Coppernapthanate Wood Preservative in strict accordance with Federal Spec. TT-W-572 Type 1 Composition B, 2" min. nominal size diameter x 10' long, no split stakes. Anchor min. 4’ into subgrade.

b. Ties: "Cinch-Tie" - 24" (<24" box), 32" (24" box and larger); black virgin flexible vinyl meeting ASTM-D-412; with double back locking configuration; galvanized roofing nail.

Manufactured by V.I.T. Products, San Diego, CA, 760/480-6702.

2. Guying: For all multi-trunk trees and trees larger than 48” box.

a. "Duck Bill" anchoring system as manufactured by Foresight Products LLC, Commerce City, CO, 80022, (303) 286-8955 or approved equal.

(1) For trees up to 3" (75 mm) diameter use:

Model 40 Duckbill Anchors with 12 feet (3.6 m) of cable attached to each anchor, 3 tree collars, and 3-1/16" (1.6 mm) cable clamps - all pre-assembled. Each anchor holds 300# (135 kg).

(2) For trees up to 6" (150 mm) diameter use:

Model 68 Duckbill Anchors with 13 feet (4.0 m) of cable attached to each anchor with a turnbuckle in line, 3 tree collars, and 6-1/8" (3.2 mm) cable clamps - all pre-assembled. Each anchor holds 1,100# (500 kg).

(3) For trees up to 11" (280 mm) diameter use:

Model 88 Duckbill Anchors with 15 feet (4.5 m) of cable attached to each anchor with a turnbuckle in line, 3 tree collars, and 6-3/16" (4.8 mm) cable clamps - all pre-assembled. Each anchor holds 3,000# (1,360 kg).

(4) For trees in planters too small for conventional guying use:Above models w/ RBK Kit.

J. Water: Furnished by Owner; transport as required.

K. Organic Mulch:

Provide organic mulch, free from deleterious materials and suitable as a top dressing around trees and shrubs. To be rich black color, well composted leaf post or 100% recycled yard trimmings composed and screened to 1/2" (or less) particle size.

Furnish sample to Landscape Architect for approval before application.

Physical Properties:

Percent Passing	Sieve Size
90-100	25.4 mm (1")
80-100	12.7 mm (1/2")
20-60	6.35 mm (1/4")

L. Gravel Mulch: As indicated on drawings

M. Metal Header:

1. Headers shall be 'Permaloc Aluminum Edging' 3/16" x 16’-0” Black or Bronze Anodized-electrically absorbed dyes into the outer layers of the aluminum, based on locations indicated in drawings. Supply 16"-0" sections with stake loops every 24" along the section, 0.110" for 3/16" gauge wall thickness; and to include eight (8)-12" aluminum stakes. Stakes are to be 6061 alloy, T-6 hardness. Manufactured by Permaloc Corp. 1-800-356-9660.

2. Headers shall be furnished as shown on the drawings and herein specified. They shall be laid true to line and grade and in a workmanlike manner. Care shall be exercised in laying headers to project adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on ground cover side of headers. Install per details and manufacturers recommendations.

N. Jute Mesh:

1. Mesh shall be "Anti-Wash Geojute" by Pacific Soil Stabilization, 800/473-1965, or approved equal. Install per manufacturer's specifications and recommendations. Material to be used for slopes 2:1 or greater.

O. Foam Weight Reducer

1. Acceptable Products

a. InsulFoam® GF (Geofoam) is a lightweight; geo-synthetic fill material that consists of closed-cell expanded polystyrene (EPS) and meets or exceeds the requirements of ASTM D6817 cut to size as required. Available from Insulfoam (909) 591-7425. Attn: Dennis Gray

b. FOAM WEIGHT REDUCER: #1 density Recycled Expanded Polystyrene (EPS) foam, cut to size as required. Product and installation materials to be low V.O.C. Available from Falcon Manufacturing 310/329-4151 or approved equal.

2. Provide shop drawing of proposed layout and size for Landscape Architect’s approval.

P. Soil Separator: On Grade Non-woven polypropylene fabric, “Carthage 30%” manufactured by Carthage Mills or approved equal.

Q. Gravel Course: Where noted on drawings. Material to be 1/4" to 1/2" washed pea gravel and shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

R. Crushed Aggregate Base: Clean, washed, crushed stone or gravel-free from deleterious material, 3/4" size. Gravel shall conform to ASTM D-1863.

S. Decorative Gravel: As indicated on drawings

T. Trunk Guard: 'Trim Guard' TG4 by V.I.T. products or approved equal.

U. Water:

1. Clean, fresh and potable, furnished by Owner and paid for by Contractor.

V. Synthetic Lawn: As indicated on drawings

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to planting operations insure site has been graded to final levels, grading swales established, and the site is free of all roots, debris. Provide for inclusion of all amendments per approved soils report, settling, etc. Contractor shall be responsible for shaping all planting areas as indicated on grading plans or as directed by the Landscape Architect.

B. Inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.

C. Do not begin planting of trees until deficiencies are corrected or plants replaced.

3.2 PREPARATION

A. Soil Preparation (On Grade)

1. Maintain the site weed free per approved weed management report.

2. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Soil should be slightly damp, but not muddy during rot tilling.

a. Prior to amending, compacted surface soil (Soil compacted greater than 85%) shall be cross ripped to a minimum 18 inch depth. (Except at existing tree drip lines as determined in the field by the Landscape Architect)

b. The following shall be uniformly broadcast and blended into the top six (6) inch depth of soil:

Application rates given are per 1000 sq. ft.:

(1) Organic amendment: 3 cu. yd. where soil organic matter is low, amended soil needs to have between 3.5 and 7% soil organic matter on a dry weight basis. (Humus material- Agricultural Peat moss approved by soils lab report).

(2) Commercial fertilizers: Triple superphosphate (0-45-0)- 4 lb.

(3) Potassium sulfate (0-0-50): 8 lb.

(4) Ureaformaldehyde (38-0-0): 8 lb.

(5) Agricultural gypsum- 30 pounds

3. At time of planting, the top two inches of all areas to be planted or seeded shall be free of stones, stumps, earth clods, or other deleterious matter 1" in diameter or larger, and shall be free from all plastic, wire, plaster, obvious foreign matter or similar objects that would be a hindrance to planting or maintenance. The top 18" of soil shall be free of all stones, stumps or other deleterious matter 1" in diameter or larger.

B. Soil Preparation (on structure):

1. Blend materials uniformly. The Contractor shall retain the approved soil testing laboratory to certify conformance of materials to specifications and to prepare one laboratory control sample of planting soil mix in accordance with specifications. Soil testing laboratory shall direct preparation and method of placement of planting soil mix and shall take and analyze at least one random sample of each 300 cubic yards of soil mix placed for conformance to specifications. Cost of such supervision and testing shall be paid by the Contractor. Certificates of analyses and final certification by testing laboratory as to mixing and placement in accordance with specifications shall be delivered to the Owner prior to planting. These conditions will be strictly adhered to.

2. Verify all stub-out locations, including water supply, electrical conduit and drainage inlets or sleeves. Verify placement of waterproof protection boards and drainage inlets or sleeves. Verify placement of waterproof protection boards and concrete topping slab. Report discrepancies to the Landscape Architect prior to backfilling planters. Confirm that water tests to verify water tightness have been completed.

3. Place drainage mat to depth indicated on plans and in specifications.

4. Place soil separator over drainage material in accordance with the manufacturer’s instructions. Lap joints 8 in. minimum. Return soil separator up walls of planting areas to min. 6 in. below top of walls. Secure the Landscape Architect’s approval prior to placing lightweight soil.

5. Place weight reducers as required.

6. Place irrigation system. The Contractor may place a 2” protective layer of specified planting mix over soil separator for protection of soil separator. Do not damage soil separator.

7. Place compacted sand under trees and to within finish surface per drawings. Compact entire depth to 90% compaction.

8. Place remaining planting soil mix maintaining uniformity of mix. Do not disturb soil separator during placement of soil mix. Bring areas to finish grade. Place in lifts not to exceed six (6) inches.

   a. All areas shall be graded so that the final grades will be 1” below adjacent paved areas, sidewalks, valve boxes, headers, planter rims, cleanout, drains, manholes, etc., or as indicated on plans. Allow for settling.

   b. Surface drainage shall be away from all building walls and door foundations.

C. Final Grades:

1. Bring soil to grades as indicated on drawings. Provide additional soil for any low points, or settlements found, or remove soil at high points.

2. Finish grading shall insure proper drainage of the site as determined by the Architect. Flow finished grades from high point to low point with not abrupt change in grade.

3. All areas shall be graded so that the final grades will be 1" below adjacent paved areas, sidewalks, valve boxes, headers, tree well grates, planter rims, clean-outs, drains, manholes, etc., or as indicated on plans for turf, and1 1/2" for shrubs and ground covers.

4. Surface drainage shall flow away from all building foundations.

5. Eliminate all erosion scars prior to commencing maintenance period.

6. Compact all soil in planting areas to final grades: min. 80% to 85% maximum unless otherwise required by soils report or for structural reasons. Soils found over compacted in planting areas to be re-ripped or tilled as required to 18” depth. The intent is to allow a shovel to be inserted without effort into the soil at any planting location. Ripping soil can be accomplished by hand shovel, ripping teeth on front end loader or other mechanical means.

D. Disposal of Excess Soil: Dispose of any unacceptable or excess soil at an off-site location approved by the Landscape Architect.

E. Note: this project requires soils testing – contractor to coordinate testing locations with landscape architect for documentation.

3.3 INSTALLATION

A. General:

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice as approved by the Landscape Architect.

2. Only as many plants as can be planted on that same day shall be distributed in a planting area. All plants shall be watered within 2 hours of planting.

3. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as

herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-Plant Weed Control:

1. After soil preparation, irrigate and fertilize all planting areas for approximately 7-14 calendar days to achieve weed germination.

2. If live weeds exist on site after irrigating and at the beginning of work, remove as recommended and applied by an approved licensed landscape pest control advisor and applicator.

3. Clear and remove all weeds by grubbing off all plant parts at least 1/4" below the surface of the soil to be planted.

4. Repeat process as necessary, or as directed by the Landscape Architect.

5. Do not plant until herbicide manufacturer indicates planting will not be affected by herbicide residue and as indicated per licensed pest control advisors recommendations.

6. Maintain site weed-free at all times. Degree of acceptability shall be solely determined by Landscape Architect.

C. Lay-Out of Major Plantings:

1. Locations for container plants shall be spotted and outlines of ground cover areas to be planted shall be marked on the ground by the Contractor before any planting or excavation begins. All such locations shall be approved by the Landscape Architect.

2. Layout shall be accomplished by setting container plants or grade stakes with plants identified in locations indicated on plans, and with painted lines for ground cover areas.

3. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting will be selected as approved by the Landscape Architect.

D. Planting of Trees and Shrubs:

1. Layout all trees for Landscape Architect’s approval prior to shrub or ground cover planting. All trees to be planted prior to installation of shrubs and groundcovers.

2. Excavate planting pits at twice the diameter of root ball with roughened surfaces as per planting detail and approved mockup.

3. The top of the root ball should be slightly above final grade. Drainage shall flow away from plant root crown. Trees or shrubs found too high or low will be re-planted to correct grade at no additional cost to Owner.

4. Backfill planting excavation for trees and shrubs with the following amended soil from a centrally mix top soil source at the following rate per cubic yard. Specific backfill requirements may vary based on recommendations from Soil Analysis:

a. Rates are for each cubic yard of soil:

(1) Organic amendment:15% approved organic amendment where soil organic matter is low.(Amended soil needs to have between 3.5 and 7% organic matter on a dry weight basis as determined by soils report.
(2) Commercial Fertilizer: Triple superphosphate (0-45-0) -1/4 pound.
(3) potassium sulfate (0-0-50) - 1/3 lb
(4) Agricultural gypsum: 1.5 lb.
(5) Urea formaldehyde: (38-0-0)- 1/3 lb

5. For new trees and palms to be planted provide two 6-8” dia. auger holes –one each side of root ball -4ft deep or to within 6-8” of the existing drainage layer as determined in the field for all trees to be planted. Backfill all augured holes with amended soils.

6. Construct a two (2") inch water beam on the outside edge of root ball.

7. Planting pits shall be backfilled with amended soil mix in 12” layers to insure even back-fill without air pockets. In addition water jet and tamp soil during backfill operations to re-move all air pockets.

8. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.

9. Install Root Barriers, as specified on plans.

10. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Cross rip all compacted areas to an 18 inch minimum depth and re-till to 6” depth.

11. Center plant in pit or trench.

12. Face plants as directed by the Landscape Architect.

13. Set plant plumb and hold rigidly in position until soil has been placed firmly around ball or roots.

14. Container plants on-structure shall be backfilled with on structure planting mix.

15. Cover the rootball with mulch.

16. All plants which settle deeper than the surrounding grade shall be raised to the correct level.

17. Box Removal: Remove bottom of plant boxes before planting. Remove sides of box without damage to root ball after positioning plant and partially backfilling.

18. Pruning: Pruning may not be done prior to delivery of plants. At the end of all planting operations provide certified arborist to prune and shape all trees as directed by the Landscape Architect.

19. Staking and Guying: Staking and guying of trees as directed by the Landscape Architect shall be completed immediately after planting. All stakes shall be installed plumb.

E. Planting of Groundcovers:

1. Flat grown plants shall remain in those flats until planting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.

2. Groundcover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawings. Triangular spacing shall be used unless otherwise noted on the drawings.

3. Each rooted plant shall be planted with its proportionate amount of flat soil. Plantings shall be immediately sprinkled after planting until the entire area is soaked to the full depth of each hole.

4. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations of this Contract shall be repaired or re-planted immediately as determined by the Landscape Architect at the contractor's expense.

F. Mulch Cover: All groundcover, perennial, and annual beds to be dressed with 3" deep layer of mulch. Keep mulch clear of root crown of shrubs and trees. Mulch is not to be applied until approval of all finished grades and drainage swales.

3.4 WATERING

A. Immediately water all plants after completion of planting operations.

3.5 CLEANING

A. The Contractor shall leave the site area broom-clean daily leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

B. After all planting operations have been completed; remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. The Contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site or the last working day of each week. All trash shall be removed completely from the site.

3.6 SCHEDULES

A. When observations are conducted by someone other than the Landscape Architect, the Contractor shall show evidence in writing of when and by whom these observations were made.

B. No site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Landscape Architect. Failure to accomplish punch list tasks or prepare adequately for desired observations shall make the Contractor responsible for reimbursing the Architect at his current billing rates per hour (plus transportation costs). No further observations shall be scheduled until this charge has been paid and received.

3.7 ACCEPTANCE AND MAINTENANCE

A. At completion of planting maintain all areas until final acceptance of the contract with all punch list items completed and accepted.

B. Replace any dead, or damaged plant material, and re-establish disturbed groundcovers or sod grass areas as determined by Landscape Architect. At completion of the contract determine the date of acceptance and start of the extended maintenance period based on Landscape Architects acceptance of the work.

C. For Maintenance intent see Design Maintenance Guidelines and Maintenance Section for all maintenance requirements.

END OF SECTION 32 90 00

SECTION 32 91 13 - WEED AND PEST CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.

B. Section Includes:

1. Weed and Pest Control

C. Related Sections:

1. Section 31 23 00: Excavating, Backfilling and Compacting for Pavements.
2. Section 32 0117: Flexible Pavement Repair.
3. Section 32 13 13: Concrete Paving.
4. Section 32 12 16 Asphalt Paving
5. Section 32 90 00: Planting

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's Product Data.

1. Within 90 days after the Notice-To-Proceed, a copy of the proposed application program shall be submitted to the Building Official for review. The submittal shall include, but not be limited to the pesticides to be used, rates of application, methods of application, and areas to which pesticides are to be applied. Prior to commencement of application, the licensed pest control adviser must receive the City Engineer's approval of the program.

1.03 QUALITY ASSURANCE

A. Pesticides, as required, shall be applied by a licensed pest control applicator in accordance with the requirements of the California Food and Agricultural Code.

B. The Contractor shall abide by all laws and codes governing weed abatement operations including but not limited to CAL-OSHA requirements and the State of California Healthy Schools Act of 2000 (AB2260).

C. Contractor responsibility during weed abatement operation and herbicide application shall include but not be limited to the following:

1. 72 hour written notice to the Owner's Construction Manager

2. Submittal of a “Pest Control Recommendation Form” to the Owner.

3. A completed and accurate MSDS (Material Safety Data Sheet) shall be posted on the site of application, and the area of application shall be posted as such.

4. The application area shall be barricaded for public safety and appropriate signage, labels and warnings posted.

5. For sites over ½ acre in area, the contractor shall utilize a Building Official or Construction Management approved plan of phasing the application. The plan shall be pre-approved by representative of the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

A. PRE-EMERGENT HERBICIDE

Shall be Balan Granular, by Elanco, or an approved equal. All pre-emergent herbicides, when required, shall be specified and applied by a licensed Pest Control Advisor.

B. ROUNDUP

Shall be a water-soluble herbicide for non-selective control of weeds containing 480 grams per liter of the active ingredient Isopropylamine salt of N-(phosphonomethyl) Glycine (Glyphosate) per U.S. gallon, as manufactured by Monsanto Chemical Company, or approved equal.

PART 3 – EXECUTION

3.1 METHODS

A. Unless specified otherwise, weed abatement shall apply to all planting areas. The abatement operation shall commence before planting but only after removals, grading, hardscape construction, installation of irrigation system, soil preparation, and fine grading of planting areas have been completed.

B. All herbicides for weed control shall be applied with a photosensitive dye which will produce a contrasting color when sprayed upon the ground. The dye shall be applied in a manner so as not to leave any stain upon surfaces.

C. Contractor shall notify the Building Official a minimum of 72 hours prior to each application of pesticide/herbicide and shall indicate the hours during which the application will occur. No applications shall be made on Saturdays, Sundays, or legal holidays, unless otherwise prior approval by the Building Official in writing.

D. The following precautions shall be observed in handling and applying herbicides:

1. Before applying, the Contractor shall read and understand all instructions provided by the manufacturer.

2. Herbicidal product shall not be used when winds are gusty or in excess of 8 miles

per hour, or when any other conditions exist which would result in drift.

3. Avoid combinations of pressure and nozzle type or adjustment that result in mist.

4. Do not apply during rain, or if rain is forecast within twelve hours. If rain occurs within a twelve-hour period, material must be reapplied after plant growth has dried out.

5. Contractor shall observe extreme care not to allow spray to contact desirable plant material. Use cardboard, plywood, or other appropriate material to shield plant materials outside of the treatment area from overspray.

6. Do not apply to bare ground.

7. Do not add other products to any herbicide mix, including spreader, stickers, or surfactants, unless required by the label directions and pre-approved by the Department of Recreation & Parks Pest Control Advisor (PCA)

E. The Contractor shall adhere to the following “grow and kill” methods:

Step 1. Clear site of all dead or living vegetative growth by hand or mechanical means.

Step 2. Thoroughly water all turf and planting areas daily to keep soil evenly moist for a period of at least two weeks.

Step 3. At the conclusion of the growth period, treat all plants within the treatment area with Roundup at an application rate of four (4) quarts of Roundup mixed in 50 gallons of clean water per acre applied by spraying. Thoroughly moisten all plant material with herbicide. If nutsedge (nutgrass) is present in any of the planting areas, “Manage” is recommended for control at a rate of 0.9. per gallon of water. Furthermore, the use of “Manage” requires the addition of 2 teaspoons (1/3 fluid ounce) of nonionic surfactant
(No Foam A) to the mix.

Step 4. Do not water or otherwise disturb treated areas for a period of two (2) weeks.

Step 5. After the two-week kill period, remove all dead plants. If any living plants are observed, the entire plant, including roots, shall be removed by hand. Minimize physical disturbance of the soil.

F. New and/or existing plants which in the opinion of the Building Official have been damaged by the application of pesticide/herbicide shall be replaced by the Contractor at their expense.

G. At the end of each work week, a written report of that week's applications of all pesticides/herbicides shall be submitted to the City Engineer.

H. Weed Suppression (Non-Herbicide Weed Removal) shall apply to all turf and planting areas. The suppression operation shall be commenced only after removals, grading, hardscape construction, installation of irrigation system, soil preparation, and fine grading of turf and planting areas have been completed. The contractor shall thoroughly water all turf and planting areas for a minimum period of two weeks prior to commencing removal. Contractor shall clear the site of all dead vegetation and living weeds by hand or mechanical means. All removed vegetation shall be properly disposed of offsite.

3.2 HERBICIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wettable powder form.

1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

a. Ciba-Geigy Corp.
b. Dow Chemical U.S.A.
c. E.I. Du Pont de Nemours & Co., Inc.
d. FMC Corp.
e. Thompson-Hayward Chemical Co.
f. U.S. Borax and Chemical Corp.
G. Or an approved equal

END OF SECTION

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sodding.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Certified complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: Medallion Plus (90% Fescue / 10% Bluegrass mix), Pacific Sod, Inc.

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 MULCHES

A. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Blend planting soil in place.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.5 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow Medallion Plus (Fescue/Bluegrass mix) to a height of 1 to 2 inches (25 to 50 mm).

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

3.6 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.7 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.8 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.9 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Sodded Turf: 30 days from date of Substantial Completion.

END OF SECTION 32 92 00

DIVISION 33
UTILITIES

DIVISION 33 – UTILITIES

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2.2 SUMMARY

A. This Section includes the following:
   1. Piping joining materials.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Sleeves.
   5. Identification devices.
   6. Grout.
   7. Flowable fill.
   8. Piped utility demolition.
   9. Piping system common requirements.
   10. Equipment installation common requirements.
   11. Painting.
   12. Concrete bases.
   13. Metal supports and anchorages.

2.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.

2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:

D.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Cascade Waterworks Mfg. Co.
    b. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    c. JCM Industries.
    d. Smith-Blair, Inc.
    e. Viking Johnson.

E. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Co.

F. Flexible Transition Couplings for Underground Non-pressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
   a. Pressure Rating: [150 psig minimum] at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
   c. Dielectric Flanges:

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Water Technologies, Inc.
2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
   a. Pressure Rating: 150 psig minimum
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.
   e. Or an approved equal

2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
   a. Pressure Rating: 150 psig minimum
   b. Gasket: Neoprene or phenolic.

c. Bolt Sleeves: Phenolic or polyethylene.

d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

b. Capitol Manufacturing Co.

c. Central Plastics Company.

d. Epco Sales, Inc.

e. Watts Water Technologies, Inc.

f. Or an approved equal

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 TRENCHLESS UTILITY INSTALLATION

A. The College incorporates trenchless utility installation (directional boring) in instances that are either economically feasible or are a better choice in dealing with possible disruption of other services on campus. Consult with the Project Manager concerning options for utilizing this method of construction.

2.6 UTILITY LINE SIGNS, MARKERS, AND FLAGS

A. The College maintains a thorough mapping of the utility systems on campus. Although special attention is given to obtaining field locations of these utility systems as they are installed, various methods of marking these utilities for future reference is also desired. The contractor is encouraged to utilize current technology available in providing on-site marking methods that will assist in utility location at later dates.

END OF SECTION

SECTION 33 10 00 - SITE WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Site water distribution systems located at least 5 feet outside the building perimeter, extending to an existing water line or meter.

C. Related Sections:

1. Section 32 23 16: Excavating, Backfilling and Compacting for structures.
2. Section 32 23 33: Excavating, Backfilling and Compacting for Utilities.
3. Section 33 30 00: Sanitary Sewer Systems.
4. Section 32 13 13: Concrete Paving
5. Section 32 84 00: Irrigation Systems.
6. Section 33 05 00 Common Work Results for Utilities

1.2 SUBMITTALS

A. Shop Drawings: Submit site plan indicating locations of lines, valves, and related appurtenances.

B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints, couplings and corrosion protection.

C. Certificates: Certificates attesting that tests set forth in referenced publications have been performed, and the performance requirements have been satisfied.

1.3 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ANSI:

a. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.

b. ANSI B18.5.2.1M Metric Round Head Short Square Neck Bolts.

2. ASME:

   a. ASME B16.3 Malleable Iron Threaded Fittings.

   b. ASME B16.4 Cast Iron Threaded Fittings.

   c. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

   d. ASME B16.26 Cast Copper Alloy Fitting for Flared Copper Tubes.

   e. ASME B18.2.2 Square and Hex Nuts (Inches Series).

   f. ASME B18.5.2M Metric Round Head Square Neck Bolts.

3. ASTM:

   a. ASTM A 47 Ferric Malleable Iron Castings.

   b. ASTM A 48 Gray Iron Castings.

   c. ASTM A 53 Pipe, Steel, Black and Hit-Dipped, Zinc-Coated Welded and Seamless.

   d. ASTM A 307 Carbon Steel bolts and Studs, 60,000 psi Tensile Strength.

   e. ASTM A 563 Ductile Iron Castings.

   f. ASTM A 563 Carbon and Alloy Steel Nuts.

   g. ASTM B 61 Steam or Valve Bronze Castings.

   h. ASTM B 62 Composition Bronze or Ounce Metal Castings.

   i. ASTM B 88 Seamless Copper Water Tube.

   j. ASTM C 94 Ready-Mixed Concrete.

   k. ASTM D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

   l. ASTM D 1785 Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

   m. ASTM D 2235 Solvent Cement for ABS Plastic Pipe, and Fittings.

   n. ASTM D 2241 PVC Plastic Pipe Fittings, Schedule 40.

   o. ASTM D 2282 ABS Plastic Pipe.

   p. ASTM D 2466 PVC Plastic Pipe Fittings, Schedule 80.

q. ASTM D 2468 ABS Plastic Pipe Fittings, Schedule 40.

r. ASTM D 2564 PVC Plastic Piping Systems.

s. ASTM D 2774 Underground Installation of Thermoplastic Pressure Piping.

t. ASTM D 2855 Making Solvent-Cemented Joints with PVC Pipe and Fittings.

u. ASTM D 3139 Joints Pressure Pipes Using Flexible Elastomeric Seals.

v. ASTM F 402 Safe Handling Of Solvent Cements, Primer and Cleaners Used for Joining Thermoplastic Pipes and Fittings.

w. ASTM F 477 Elastomeric Seals for Joining Plastic Pipes.

4. American Water Works Association (AWWA) Standards:

a. AWWA C104/A21.4 Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water

b. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.

c. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron pressure Pipe and Fittings.

d. AWWA C153/A21.53 Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.

e. AWWA C500 Gate Valves for Water and Sewerage Systems.

f. AWWA C503 Wet- Barrel Fire Hydrants.

g. AWWA C508 Swing-Check Valves for Waterworks Service, 2 inches through 24 inches NPS.

h. AWWA C509 Resilient-wedge seated Gate Valves for Water and Sewerage Systems.

i. AWWA C511 Reduced-Pressure Principal Backflow-Prevention Assembly.

j. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.

k. AWWA C651 Disinfecting Water Mains.

l. AWWA C 800 Underground Service Line valves and Fittings.

m. AWWA C900 PVC Pressure Pipe, 4 inches through 12 inches, for Water Distribution.

n. AWWA M23 PVC Pipe - Design and Installation.

5. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:

a. MSS SP-80 Bronze Gate, Globe, Angle and Check Valves.

6. Uni-Bell PVC Pipe Association (UBPPA):

a. UBPPA UNI-B-3 Installation of PVC Pressure Pipe.

b. UBPPA UNI-B-8 Direct Tapping of PVC Pressure Water Pipe.

c. UBPPA UNI-B-13 Standard Performance Specification on joined restrained devices for use with Poly Vinyl Chloride (PVC) Pipe.

7. Underwriters Laboratories Inc. (UL):

a. UL 246 Hydrants for Fire-Protection Service.

b. UL 262 Gate Valves for Fire-Protection Service.

c. UL 312 Check Valves for Fire-Protection Service.

d. UL 789 Indicator Posts for Fire-Protection Service.

B. Provide all valves from the same manufacturer.

1.4 PRODUCT HANDLING

A. Store items above ground on platforms, skids, or other required supports.

B. Protect materials from direct sunlight.

C. Protect coating and linings on piping, fittings, and accessories from damage. Repair and/or replace damaged coatings or linings.

PART 2 - PRODUCTS

3.1MATERIALS

A. Pipes and Tubes:

1. Pipe sizes up to 2.5 inches shall be copper water tubing,

a) Above Ground - Type L hard drawn copper: ASTM B88. ANSI H23.1
b) Underground - Type K hard drawn copper: ASTM B88. ANSI H23.1

IAPMO IS. Muller Brass, Cambridge-Lee Halstead, or equal.

2. If soil report indicates corrosive condition, an approved protective wrap shall be used to completely isolate and protect all underground copper tubing and extend past the surface a minimum 12 inches. The excess wrapping shall be trimmed down and taped to copper tubing with 10 mill PVC pipe tape at grade level of concrete or asphalt.

Use the following for pipe sizes up to 2.5 inches, only if special conditions require:

3. PVC Schedule 40: pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in compliance to ASTM D1785 and D2665 (where applicable.

4. Underground pipe sizes 3 inches and larger shall be PVC water main pipe material complying with ASTM D 1784 Cell Class 12454B and AWWA C900. Piping shall be plain end or gasket bell end, pressure class 200 (DR14) with cast iron pipe equivalent OD.

Use the following for pipe sizes up 3 inches and larger, only if special conditions require:

5. Ductile-Iron, Push-on-Joint, Fire-Service Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include rubber compression gasket according to AWWA C111.

6. Stainless steel pipe, sizes 2 inch and larger may be used above or below ground with the approval of the Architect in lieu of copper, ductile iron, or plastic. Stainless steel pipe shall be schedule 10, 304 s. s. pipe (tubing) conforming to ASTM A312. Flanges shall be HR carbon steel plated conforming to ASTM A36. Flange exterior coating shall be Zink plated conforming to ASTM B633-85.Welding wire/rod shall be 308L SS wire rod conforming to ASME SF A5.9.

    a. Underground connections shall be welded s. s. pipe or made with a welded flange connection.

    b. Above ground connections may be with either flange or grooved Victaulic type coupler. Victaulic couplers shall be constructed of ductile iron and conform to ASTM A-395, 65-45-15. Gaskets shall be of EPDM material, UL classified according to ANSI/NSF 61.

    c. If soil report indicates corrosive condition, an approved protective wrap shall be used to completely isolate and protect all underground steel tubing and extend past the surface a minimum 12 inches. The excess wrapping shall be trimmed down and taped to steel tubing with 10 mill PVC pipe tape at grade.

B. Pipe and Tube Fittings

1. Poly Vinyl Chloride (PVC) Water Main: Fittings shall be gray-iron or ductile iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement

mortar lining conforming to AWWA C104/A21.4, standard thickness unless otherwise indicated on Drawings. Fittings shall be mechanical joints.

2. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber compression gaskets according to AWWA C111.

Use the following for small size pipes, only if special conditions require:

3. PVC Piping Solvent-Cement Joints: According to ASTM D 2672 and ASTM D 2855. Handle cleaner, primer, and solvent cement according to ASTM F 402.
4. Fittings: Wrought Copper, ANSI/ASME 81 6.22; wrought copper and copper alloy solder joint pressure fittings
5. Corrosion Protection: Polyethylene Encasement; AWWA C105; Polyethylene film conforming to ASTM 0-1248 and installed per 5-4.2.1, Method "A".

C. Joints and Jointing Materials:

1. Pipe joints shall be push on as specified in ASTM D 3139.
2. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints as specified in AWWA C111/A21.11.
3. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling installation.
4. Gaskets for push on joints for pipe shall conform to ASTM F 477.
5. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.
6. Sleeve-type mechanically coupled joints may be provided instead of push-on joints on plain-end PVC plastic joints. Comply with requirements of ASTM D 3139.
7. Make all connections between steel or iron pipe and copper pipe with approved insulating coupling.
8. Nipples: Same material as pipe on which they are used. Avoid use of close nipples if possible.
9. Fittings for copper water piping: Forged copper fittings sweat soldered using lead-free solder. Do not use cast copper.
10. Adapters for unions and valves: Solder to IPS.

D. Ductile-Iron Piping: The following materials apply:

1. Push-on Joints: AWWA C111 rubber gaskets and lubricant.

E. Valves for Copper

1. Globe valves: Provide bronze or iron bodies, with brass rings and renewable composition discs equivalent to Crane No. 1, 351, or 1310.

2. Check valves: Provide swing type, with bronze bodies, equivalent to Crane No. 37, 372, or 1342.

3. Gate valves 3 in. and smaller: Provide bronze or iron body gate valves, with non-rising stem with wedge disc, equivalent to Crane No. 440. Elsewhere, provide iron body gate valves, equivalent to Crane No. 460.

4. Angle valves 3 in. and smaller: Provide bronze body, RS Class 125, threaded. Two (2) in. and larger: Provide cast iron body, OS & Y, Flanged.

5. Approved manufacturers of valves furnished and installed are Crane, Lunkenheimer, Powell, or approved equivalent.

6. Provide gate and globe valves of type permitting repacking while valve is under pressure.

7. Packing shall be fiberglass graphite composition with Inconel were insert or approved equivalent.

F. Gates Valves for PVC:

1. Non-rising stem type with resilient wedge gates or iron body bronze wedge gates and mechanical joint ends conform to AWWA C500.

2. Non-rising stem type with mechanical joints ends shall conform to AWWA C509.

3. Valves designed for a working pressure of 175 psi shall be inside-screw type with operating nut, and resilient wedge type gate. Valve shall be provided with mechanical joints as required for the pipe to which it is intended to connect.

4. Valves with UL listing of 262 shall conform to AWWA C500. Valves shall open by counter-clockwise rotation of valve stem.

5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.

6. Sleeve type mechanical couplings may be provided instead of mechanical and push on joint ends.

7. Valve ends and gaskets for connection to sleeve type mechanical couplings shall conform to specified requirements for the joint or coupling.

8. Valves shall be of one manufacturer.

G. Gate Valves in Valve Pits:

1. Outside screw and yoke rising stem type valves with resilient wedge gates and flanged ends shall conform to AWWA C500.

2. Outside screw and yoke rising stem type valves with flanged ends shall conform to AWWA C509.

3. Outside screw and yoke type Valves with double disc gates or split-wedge type gate and flanged ended ends shall be designed for 175 psi and conform to UL 262.

4. Provide valves with hand wheels that open by counterclockwise rotation of the valve stem.

5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.

H. Check Valves for PVC:

1. Valves shall be swing-check type conforming to AWWA C508 or UL 312.

2. Valves shall be provided with cast iron or steel body and cover, flanged ends and clear port opening.

3. Valves shall be designed for a working pressure of 175 psi.

I. Valve Boxes: Valve boxes shall be cast iron and painted with bituminous paint. Shaft shall be adjustable with the word “WATER” cast on the valve box cap. Box shaft shall be 5-1/4 inches minimum diameter. Provide either pedestrian or vehicular traffic type as required. Valve boxes shall be as manufactured by Alhambra Foundry Company, or equal.

J. Mechanical Thrust Restraint:

1. Restraint shall be incorporated into the follower gland.

2. Restraint shall consist of individually actuated wedges that increase resistance to pull out as internal pressure or external forces increase.

3. Gland shall be ductile iron conforming to ASTM A 536.

4. Provide twist off nuts and tee-head bolts of the same size to ensure proper actuating of restraint devices.

5. Restraining device shall be provided with pressure rating equal to that of the pipe on which it is installed.

6. Restraining gland shall be UL listed.

7. Mechanical thrust restraint devices shall be EBAA Iron “Megalug”, or equal.

K. Restraint Device Adapters:

1. Restrained flange adapters shall be provided instead of threaded or welded flange spool pieces on plain end of ductile iron or PVC pipe.

2. Flange adapters shall be manufactured of ductile iron conforming to ASTM A 536 and be provided with flange bolt circles compatible with ANSI/AWWA C115/A21.15.

3. Restraint of flange adapter shall consist of a multiple number of individually actuated gripping wedges to maximize restraint capability.

4. Torque limiting actuating screws shall be provided to insure proper initial set of gripping wedges.

1. Flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow at least 0.6 inch of gap between end of pipe and mating flange without affecting integrity of seal.

5. Flange adapter shall be provided with a safety factor of at least 2:1 for rated pressure.

6. Restraint device adapters shall be EBAA Iron “Megaflange”, or equal.

L. Tracer Wire for Nonmetallic Pipes: Tracer wires shall be electrically continuous #14 copper tracer wire, Type TW, blue plastic covered for domestic water and red for fire sprinkler. (Aluminum wire is prohibited). Provide in sufficient length to be continuous over each installed section of nonmetallic pipe.

M. Pipe markers shall be a concrete plaque inscribed with the word “WATER.”

N. Water Service Line Materials:

1. Copper Tubing: Copper tubing shall conform to ASTM B 88, Type L.

2. Fittings for Copper Tubing: Fittings for solder-type joints shall conform to ANSI B16.18 or ASME/ANSI B16.22. Fittings for compression-type joints shall conform to ASME/ANSI B16.26, flared tube type.

3. Water Service Line Appurtenances:

a. Corporation stops shall be ground key type; manufactured of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint or flared tube compression type joint connection. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing and shall conform to ASME/ANSI B16.26.

b. Goosenecks shall be type K copper tubing. Joint ends for goosenecks shall be as required for connecting to corporation stop and service line. Where multiple gooseneck connections are required for individual service, connect goosenecks to service line through brass or bronze branch connection; the total clear area of branches shall be at least equal to clear area of service line. Length of goosenecks shall be as indicated or required.

c. Curb or service stops shall be ground key, round way, inverted key type; bronze, conforming to ASTM B 61 or ASTM B 62; and rated at 150 psi.

Ends shall be as required for connection to service piping. Arrow shall be cast into body of curb or service stop indicating direction of flow.

d. Gate valves 2.5 inches and larger shall be MSS SP-80, Class 150, solid wedge, or resilient wedge gate, and non-rising stem. Valves shall be provided with flanged end connections. Provide hand wheel operators if easily accessible. Provide operating nut if inside a vault, pit or valve box.

e. Gate valves in valve pits 2 inches, and smaller shall be MSS SP-80, Class 150, bronze, solid wedge, inside screw, rising stem. Valves shall be provided with flanged end connections or threaded end connections with union on one side of valve and hand wheel operator.

f. Valve boxes shall be provided at each gate valve. Valve boxes shall be as of size suitable for valve on which it is installed.

O. Backflow Preventer Assemblies:

1. General: Manufactured backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated. All backflow preventers and detector check valve assemblies shall be of “reduced pressure” type. (RPPD or RPDA respectively)

2. Working Pressure: 200 psig (1380 kPa), unless otherwise indicated.

3. Indicating valves: All aboveground detector check valve assemblies (RPDAs) shall be equipped with “indicating” type gate valves – OS&Y raising stem valves.

4. Assembly shall be provided with flanged connections, ductile iron with fusion bonded epoxy coated construction, bronze, or stainless steel.

5. Internal parts shall be designed for replacement without removing valves from line.

6. Double check backflow preventer assembly shall consist of two independently acting spring cam or poppet style check valves, 2 shut-off valves and 4 test cocks. Check valve shall be designed to provide drip tight closure against reverse flow, low pressure drop at maximum flow capacity. Spring-loaded checks shall cause valve to seal against a higher inlet pressure than outlet pressure when there is no flow.

7. Double check backflow preventer assembly shall meet AWWA Standard C510-89. Assembly shall be reduced pressure double check detector assembly:
Ames 2000ss Febco 850 Watts 709 Wilkins 350, or equal.

8. Reduced pressure backflow preventer assembly shall consist of two check valves located between two shut-off vales with an area of reduced pressure between two check valves and a relief device arranged to discharge to atmosphere.

a. Comply with AWWA Standard C511.

b. Fluctuation in piping pressure shall not cause cycling. Backflow preventer shall automatically maintain low pressure zone to positively prevent backflow of water into system. Assembly shall automatically indicated failure of any part vital to backflow prevention by the continuous discharge relief device.

c. Reduced pressure backflow preventer assembly shall be Cla-Val Model RP-4, or equal.

9. Backflow prevention assemblies (devices), shall be tested and certified by a certified backflow tester, and a test report shall be provided to the water agency having jurisdiction. Testing shall be performed in the presence of the IOR.

10. Exterior Finish: Color as indicated in Architectural plan (Red or yellow if directed by Water Purveyor or local Fire Department) alkyd-gloss enamel paint. Entire device above and including connection to riser shall be sandblasted, if necessary, after installation and re-painted. Coordinate color with Owner or Architect.

PART 3 - EXECUTION

3.1 EXCAVATION, BACKFILLING AND COMPACTING

A. Conform to requirements in Section 312333: Excavation, Backfilling and Compacting for Utilities or Section 312300: Excavating, Back-Filling and Compacting for Pavements.

3.2 PIPE INSTALLATION

A. Project site water lines shall terminate approximately 5 feet from buildings, unless otherwise indicated on Drawings. Temporarily cap or plug terminals for future connection to building.

3.3 CLEARANCES OF WATER LINE

A. Building or Structures: 2 feet.

B. Parallel to Sewer Line:

1. Water line 4 inches or less in diameter shall not be installed in a common trench with the building sanitary drain unless the bottom of the water line is at least 12 inches above the top of the building sanitary drain or where the water line is installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the building sanitary drain.

2. Water mains 6 inches and larger in diameter shall be separated from the project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, in accordance with the requirement of the State of California, Human and Welfare Agency, Department of Health Services.

C. Crossing Sewer Line:

1. A water main shall be separated from sanitary sewer in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2), unless modified herein.

2. Install water main a minimum of 12 inches clear, above or below a sanitary sewer.

3. A water main 6 inches or greater in diameter, crossing under a Project site sanitary sewer line, shall be installed with all their joints located at least 10 feet away from each side of the sanitary sewer line.

4. A water main 6 inches or greater in diameter, crossing over a Project site sanitary sewer line, shall be installed with all their joints located at least 4 feet away from each side of the sanitary sewer line.

D. Install all water mains no closer than 10 feet horizontally clear from the edge of sewage leach fields, seepage pits, and septic tanks.

3.4 PIPE INSTALLATION AND JOINING

A. Remove fins and burrs from pipe and fittings.

B. Clean piping, fitting, valves, and accessories before installing. Maintain items in a clean condition.

C. Provide proper facilities for lowering sections of pipe into trenches. Do not drop into piping, fittings, or other materials into trenches. Accurately cut pipe and install without springing or forcing. Replace any piping or fitting that does not provide sufficient space for proper installation of joining material.

D. Blocking or wedging between bells and spigots is not permitted. Install bell and spigot pipe with bell end pointing in the direction of flow.

E. Install piping to the lines and grades indicated or required. Low points and dips are not permitted. Support piping at proper elevation and grade with secure and uniform supports. Wood support blocking is not permitted. Where sand cement slurry will not be furnished for backfill, install piping so that full length of each section of pipe and each fitting will solidly rest on pipe bedding. Excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated or required for installation. Provide proper allowances and devices for expansion and contraction of piping and systems.

F. Maintain trenches free of standing water until pipe joints have been installed.

G. At the end of each day close open ends of pipe with temporary wood blocks or bulkheads.

H. Do not install piping when trench or weather conditions prevent proper installation.

3.5 INSTALLATION OF TRACER WIRE AND PIPE MARKERS

A. Tracer Wire: Install continuous length of tracer wire for full length of each run of nonmetallic pipe. Fasten wire to top of pipe in such a manner that it will not be displaced during construction operations. Wire shall be fastened to pipe at not greater than 20-foot intervals. Wire shall terminate above finished grade with a 12 inch lead taped around each riser. Provide a tracer wire to grade under a permanent marker where straight-line transitions of metallic to non-metallic pipe are installed.

B. Underground Pipe Markers: Provide markers at grade where non-metallic pipe is installed and for each horizontal change in direction.

3.6 CONNECTIONS TO EXISTING WATER LINES

A. After IOR has inspected installation, perform connections to servicing water lines. Schedule service shutdown for connecting new system at a time causing minimum disruption.

B. Use a tap or drilling machine with valve and mechanical joint type sleeves for connections to waterlines under pressure, only if all other means of scheduling a shutdown time have been unsuccessful, and with the approval of the responsible engineer, and IOR.

C. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to branch. Open valve, attach drilling machine, perform tap, close valve, and remove drilling machine, without interruption of service. Notify the IOR in writing at least 5 days prior to the date of scheduled connections.

3.7 INSTALLATION OF PVC PLASTIC WATER MAINS

A. Unless otherwise indicated, install pipe and fittings as specified and in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, “Installation”.

B. Jointing:

1. Provide push on joints with elastomeric gaskets specified for this type of joint, furnishing either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push on joint connections, provide pipe with push on joint ends furnished with factory installed bevel; for push on joint connections to metal fittings, valves and other accessories, square cut spigot end off pipe end.

2. Provide push on joint lubricant recommended by manufacturer.

3. Install push on joints for pipe-to-pipe connections in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, "Installation."

4. Install push on joints for connection to fittings, valves, and other accessories in accordance with requirements of UBPPA Uni-B-3 and with applicable requirements of AWWA C600.

5. Compression-type joints/mechanical-joints with gaskets, glands, bolts, nuts and internal stiffeners shall be installed in accordance with the requirements of UBPPA UNI-B-3 and AWWA C600 and Appendix A to AWWA C 111/A21.11.

6. Square cut spigot off end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

7. Sleeve-type mechanical couplings shall be provided in strict accordance with coupling manufacturer's recommendations using internal stiffeners as specified for compression-type joints.

C. Provide mechanical thrust restraint devices for anchorage and piping unless thrust blocks are indicated on the Drawings. Thrust blocks shall be installed in accordance with the requirements of UBPPA UNI-B-3 except that size and location of blocks shall be as indicated. Thrust blocks shall be provided as specified in Section 02770: Site Concrete Work.

3.8 INSTALLATION OF VALVES

A. Provide gate valves conforming to AWWA C 500 and UL 262 in accordance with AWWA C600 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".

B. Provide gate valves conforming to AWWA C 600 in accordance with AWWA C 509 for valve and fitting installation and with recommendations of AWWA C 500 Appendix "Installation, Operation, and Maintenance of Gate Valves".

C. Provide gate valves on PVC mater mains in accordance with AWWA M23 Chapter 7, "Installation."

D. Provide check valves and fittings in accordance with applicable requirements of AWWA C600 unless noted otherwise on the Drawings.

E. Provide gate and check valve joints as specified for the type of joints between pipe and fittings.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

A. Install in accordance with manufacturer's recommendations.

3.10 WATER SERVICE LINE CONNECTION TO WATER MAINS

A. Connect service line to main by corporation stop and gooseneck. Install service stop as indicated on the Drawings. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B8 and AWWA M23, Chapter 9, "Service Connections".

B. Special Requirements for Plastic Piping: Unless otherwise indicated, install pipe and fittings in accordance with ASTM D 2774 and ASTM D 2855. Handle solvent cements for

plastic pipe jointing in accordance with ASTM F 402. Install joints according to ASTM D 2855. Install other joints to materials other than pipe materials in accordance with plastic pipe manufacturer's recommendations.

C. Connect plastic pipe service lines to corporation stops and gate valves according to plastic pipe manufacture's recommendations.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. When water piping has been installed and tested, sterilize system before use and/or Substantial Completion.

B. Inject solution of liquid chlorine or sodium hypochlorite and water containing at least 50 PPM of free chlorine into a system in a manner to ensure that entire system is completely filled with solution. During this procedure operate valves and test outlets for residual chlorine. Continue injection until outlets indicate at least 59 PPM of free chlorine.

C. After injection, isolate system and hold solution in retention for a period of at least 8 hours. Perform tests for residual chlorine after retention. If such tests indicate less than 50 PPM of residual chlorine, repeat entire procedure. After satisfactory sterilization has been verified, flush entire system until all traces of chlorine have been removed or until chlorine content is no greater than in existing water supply.

3.12 ELECTROLYSIS PREVENTION

A. A minimum 6-inch-long brass nipple shall be installed at locations specified or as required. Flanges shall be provided with a complete insulating component consisting of; gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at locations indicated or as required. Dielectric fittings are prohibited.

B. Where steel or cast iron below grade connects to copper or brass piping above grade, the transition from steel or cast-iron pipe to copper or brass pipe shall be installed in an above grade accessible location.

C. Underground connections between dissimilar metals shall be in accessible yard boxes.

D. Above ground dielectric connections shall be exposed.

3.13 ABANDONING WATER LINES AND STRUCTURES

A. Water lines and all appurtenances to be abandoned in place shall be cut and removed from all areas where new Work is being installed.

B. Cap or plug abandoned existing drain lines in a code recognized manner.

3.14 TESTS AND INSPECTIONS

A. Provide labor, equipment, materials, test equipment and incidentals required for performing required field tests.

B. Tests shall not be performed for 5 days after concrete thrust blocks have been installed.

C. Testing Procedure: Water mains and service lines shall be tested in accordance with applicable specified standard.

1. Test PVC plastic water system in accordance with UBPPA UNI-B-3 for pressure and leakage. The amount of leakage from PVC piping shall not exceed the amounts given in UBPPA UNI-B-3, except that no leakage is permitted for joints installed with sleeve type mechanical couplings.

2. Test water service lines in accordance with applicable requirements of AWWA C 600. No leakage is permitted.

3. Pressure testing: Before pressure test, fill portion of piping being tested with water for a minimum of 24 hours. Provide hydrostatic pressure of at least 50 psi greater than the maximum working pressure of tested system, but no less than 200 psi hydrostatic test pressure for system piping of 2 inches in diameter and larger. Provide and maintain hydrostatic test pressure for at least 2 hours to ensure no leakage of any portion of piping or appurtenances under pressure test.

3.15 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.16 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 33 30 00 - SITE SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Site sanitary sewer systems 5 feet away from the building wall, unless noted otherwise, to existing public and/or Project site sanitary sewer.

C. Related Sections:

1. Section 32 23 16: Excavating, Backfilling and Compacting for structures.
2. Section 32 23 33: Excavating, Backfilling and Compacting for Utilities.
3. Section 33 30 00: Sanitary Sewer Systems.
4. Section 32 01 17: Flexible Pavement Repair.
5. Section 32 13 13: Site Concrete Work.
6. Section 33 10 00: Water Distribution Systems.
7. Section 33 40 00: Storm Drainage Systems.
8. Section 32 840 0: Irrigation Systems.
9. Division 23: Mechanical.

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.

B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.

C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Standard Specifications for Public Works construction, current edition.

2. California Plumbing Code, CPC, current edition.

3. California Administrative Code, Title 22, Section 64630(e)(2).

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipeline:

1. Acid pipeline from neutralizing tank to building sanitary drain or Project site sanitary sewer: See Division 15 for corrosive waste piping.

2. Building or Project site sanitary sewer:

a. Vitrified clay extra strength with plain end, meeting the requirements of ASTM C 700, installed with mechanical compression couplings. Joints conforming to ASTM C 425. Installation shall be in accordance with ASTM C 12. Manufactured by Mission Clay Products, or equal.

B. Cleanout Assemblies: Cleanout plug shall be line size.

1. In covered concrete-paved floors: Iron body with UPC recognized plug, top, and adjustable sleeve, cut-off ferrule, polished brass/nickel/bronze, and secured scoriated cover:

Square:	SMITH 4053	JOSAM 56030-2	ZURN Z-1400	
Round:	SMITH 4033	JOSAM 56010-2	WADE W-6000	ZURN Z-1400

2. Outside covered concrete-paved floors: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferrule, UPC recognized brass type plug, scoriated tractor type cover:

SMITH 4233	JOSAM- 56050-2	ZURN Z-1402-HD	WADE W-7030-Y

3. In yard boxes: Raised threaded head brass plug.

WADE 8590A, or equal.

C. Yard Boxes: Brooks No. 3-TL, or equal, with cast-iron locking cover with the word “SEWER,” embossed on the cover in one-inch high upper-case lettering.

D. Concrete, Mortar and Related Materials: Conform to Section 02770: Site Concrete Work, unless noted otherwise.

E. Metal Covers, Frames and Accessories:

1. Conform to Section 206 – Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.

2. Metal Covers and Frames: Vandal-resistant design and construction.

3. Hot-dip galvanize steel parts after fabrication and prior to assembly in accordance with Section 210 – Paint and Protective Coating of the Standard Specifications for Public Works Construction.

F. Bedding Materials: Conform to requirements in Section 31 23 33: Excavation, Backfilling and Compacting for Utilities or Section 312300: Excavating, Back-Filling and Compacting for Pavements, as required.

PART 3 – EXECUTION

3.01 SANITARY SEWER INSTALLATION

A. Install sanitary sewers in a uniform alignment and slope to the point of connection as indicated. Before trench excavation, verify size, material, depth, and location of the point of connection.

B. Unless indicated otherwise, pipe slope shall not be less than 1/4 inch per foot or 2 percent unless pipe inverts are indicated. Where invert elevations are indicated, install pipe at a uniform slope between inverts. Slope may be less upon the review of the Architect.

C. Join pipes and fittings as recommended by the manufacturer.

3.02 CLEARANCE OF SANITARY SEWERS

A. Buildings or Structures: 5 feet.

B. Parallel to Water Line:

1. Building sanitary drain, starting 5 feet from the building wall to Project site sanitary sewer or public sewer, is not permitted to be installed in a common trench with a potable water line unless the bottom of the water line is at least 12 inches above the top of the sanitary sewer.

2. In addition, the potable water line shall be installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the sanitary sewer or building sanitary drain.

3. Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, shall be separated from a potable water line in accordance with the requirements of the State of California, Human and Welfare Agency, Department of Health Services.

C. Crossing Water Line:

1. Building sanitary drain shall be installed a minimum of 12 inches below the potable water line.

2. Project site sanitary sewer shall be separated from the potable water main in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).

3.03 MANHOLES

A. Provide manholes in accordance with the Standard Plans for Public Works Construction, unless otherwise indicated.

B. Adjust manholes in accordance with the sub-section 302-5.8 Manholes (and other structures) of the Standard Specifications for Public Works Construction.

3.04 CLEANOUTS

A. Provide cleanout at the upper terminal for each sanitary pipeline, at intervals not exceeding 100 feet in straight run and any fraction thereof and for each aggregate horizontal change in direction exceeding 135 degrees.

B. Install required cleanouts before back filling of horizontal pipelines.

C. In unpaved and asphalt-paved areas, install cleanouts in yard boxes 2 inches below the yard box cover.

D. In concrete-paved areas, extend cleanouts flush with finish grade.

E. In traffic areas, install countersunk cleanout plugs where raised heads protrude.

3.05 ABANDONED SEWERS AND STRUCTURES

A. Plug or cap every abandoned sanitary sewer within 5 feet of the property line in a code required manner.

B. Demolish abandoned sanitary structures such as cesspool, septic tank, sewage pit, and manholes to a minimum depth of 5 feet below the finish grade, including removal of sewage. Disconnect any piping. After inspection, completely fill with earth, sand, gravel, cement-sand slurry, or other required material.

3.06 TESTING

A. After installation, test each sanitary drain and/or sewer and each section between successive manholes for either infiltration or exfiltration. Test shall be conducted in accordance with Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.

B. Where excessive ground water is encountered test the pipeline for infiltration.

C. When infiltration or exfiltration exceeds allowable amounts as set forth in the Section 306 formula, perform repairs or replacements as necessary to comply with the required limits.

3.07 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.08 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 33 40 00 - STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Catch basins, grates and frames; culverts; curb inlets; drainage pipes; sub-surface drains; manhole covers and frames; surface run-off collection.

C. Related Sections:

1. Section 32 23 16: Excavating, Backfilling and Compacting for structures.
2. Section 32 23 33: Excavating, Backfilling and Compacting for Utilities.
3. Section 32 01 17: Flexible Pavement Repair.
4. Section 32 13 13: Site Concrete Work.
5. Section 32 84 00: Irrigation Systems.
6. Section 33 05 00 Common Work Results for Utilities
7. Section 33 30 00: Sanitary Sewer Systems.

1.2 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.3 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog data for all required materials. Include technical data for accessories, information concerning gaskets, joints and couplings, for the following:

1. Pipe and fittings
2. Cleanouts, and area drains, grates and covers.

B. Shop drawings for pre-cast concrete manholes and other structures. Include frames, covers, and grates.

C. Shop drawings for cast-in-place concrete or field-erected masonry manholes and other structures. Include frames, covers, and grates.

D. Reports and calculations for design mixes for each class of cast-in-place concrete.

1.5 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: For stormdrain with pipes larger than 12 inches diameter, comply with Standard Specifications for Public Works Construction, (SSPWC) "Green Book", current edition.

B. Environmental Agency Compliance: Comply with regulations pertaining to storm drainage systems.

C. Utility Compliance: Comply with regulations pertaining to storm drainage systems. Include standards of water and other utilities where appropriate.

D. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, structures or fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions. Protect exposed edges of pre-cast concrete drain inlets from chipping or damage.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public (or private) utility records, and verify existing utility locations and downstream join conditions.

B. Locate and mark existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Engineer or Owner's Construction Manager not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Owner's Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Storm Drain Pipe: Provide in conformance with Section 207 - Pipes and Section 208 - Pipe Joint Types and Materials of the Standard Specifications for Public Works Construction. Refer to the Drawings for required pipe material.

B. Perforated Subsurface Drain Pipe: Provide shop-perforated with perforations symmetrically located within a maximum arc of 160 degrees. Perforations shall provide a total open area of at least 0.3 square inches per linear foot of pipe, with a minimum of one perforation per linear foot, except for joint areas. Perforation shall be either holes or slots. Hole diameters of 1/4 inch minimum to 3/8 inch maximum. Width of slots of 3/16 inch minimum to 5/16 inch maximum with slot length not exceeding 4 inches.

1. Acrylonitrile Butadiene Styrene (ABS) Pipe: ASTM D 2751, with a maximum SDR of 35.

2. Polyvinyl Chloride (PVC) Pipe: ASTM D 3034, with maximum SDR of 35 and with flexible elastomeric seal joint.

3. High Density Polyethylene (HDPE) Pipe with corrugated exterior and smooth interior wall, with gasketed bell-and-spigot joints.

4. Acrylonitrile butadiene styrene (ABS) pipe shall be joined using solvent cement or elastomeric joints and shall be in accordance with ASTM D 2751.
5. Polyvinyl Chloride (PVC) pipe gasket joints shall be in accordance with ASTM D 3212.
6. Furnish subsoil drainage pipe prewrapped or wrap pipe with Mirafi 14ON Filter Fabric, or Bidim C22 or C28 fabric manufactured by Monsanto; or equal.

C. Concrete, Mortar and Related Materials: Conform to Section 321313: Site Concrete Work.

D. Metal Covers, Grates, Frames and Accessories:

1. Conform to Section 206 - Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
2. Hot-dip galvanize steel parts after fabrication and before installation, in accordance with Section 210 - Paint and Protective Coating of the Standard Specifications for Public Works Construction.
3. Grates and Frames: Vandal-proof design and construction.

E. Bedding Material for Pipe: Conform to the requirements of Section 322316: Excavating, Backfilling and Compacting for Structures and Section 322333: Excavating, Backfilling and Compacting for Utilities, as required.

F. Filter Material for Subsurface Drain: Non-woven geotextile filter fabric, Mirafi 14ON, or equal.

G. Aggregate Around Perforated Pipe: 6 inches of gravel containing no particles finer than a 3/8 inch to 1/2 inch sieve opening size.

H. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

2.2 RELATED MATERIALS:

A. Precast Concrete Units: Catch basins and inlets shall meet the requirements of ASTM C 913 and manhole sections shall meet the requirements of ASTM C 478 except that Portland cement shall be Type II, low alkali. Cleanout sections shall comply with ASTM C 478 85a except that Portland cement shall be Type II, low alkali. Gaskets for joints between sections shall comply with ASTM C 443 85a.

Precast units shall meet H20 traffic load conditions, unless noted otherwise on the drawings. Use J&R, Brooks, Kristar "Dura Drain" or approved equal.

B. Manhole Frame and Cover Sets: Alhambra Foundry Company Inc., Model No. A¬ 1495 with letter "D" designation or approved equal and meet H20 traffic load conditions.

C. Fabricated Steel Traffic and non-Traffic Gratings and Frames: Fabricate from steel meeting the requirements of ASTM A 36 or ASTM A 576, Grates A 1233, A2010, A 2012. Welding shall meet the requirements of AWS D1.1. Burrs, rough and sharp edges and other flaws shall be removed. Warped pieces shall be straightened after all fabrication. Gratings and frames shall be galvanized in accordance with Standard Specifications, (SSPWC) Section 210-3.

D. Concrete Appurtenances: Concrete for catch basins and manholes shall be 3,200 PSI minimum, complying with Section 201 of the Standard Specifications.

E. Cleanout Covers: Alhambra Foundry Company, Inc. Model No. A 1242, heavy duty lamp pole frame and cover, or equal approved.

F. Concrete for Cleanouts and Manholes: 3,200 PSI minimum, complying with Section 201 of the Standard Specifications for Public Works Construction.

G. All grates shall be ADA compliant, (1/2" max grate opening) unless noted otherwise.

H. Heel-proof grates shall have 1/4" max grate opening. Traffic rated "heel-proof" grates: INWESCO 12x12; 18x18; 24x24, custom sizes, or approved equal. Non-traffic rated "heel proof" grates: NDS #1214 (12x12), NDS #915, #917, #920 or approved equal for small size drain inlets.

I. Triton Catch Basin Insert by Contech Stormwater Solutions Inc, "Flo-Guard" Pro inserts by Kristar Enterprises, Inc or approved equal.

J. Perforated 12 inch HDPE "flat panel" subdrain per ADS, or approved equal.

K. Cast Iron Pipe: Hub and spigot cast iron soil pipe and fittings shall conform to ASTM A 74; joints shall be made either by caulked lead and oakum or by compression gaskets such as TY-SEAL which conform to ASTM C 564.

L. CIP STANDARDS: ASTM A 74: Cast Iron Soil Pipe and Fittings. ASTM C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings

PART 3 - EXECUTION

3.1 EXCAVATION, BACKFILLING AND COMPACTING

A. Conform to the requirements of Section 322316: Excavating, Backfilling and Compacting for Structures and Section 322333: Excavating, Backfilling and Compacting for Utilities, as required.

3.2 INSTALLATION OF PIPE

A. Conform to Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.

B. Non-ferrous drainpipe installed with less than 12 inches of cover to finish grade shall be provided with a 4-inch-thick concrete pipe encasement.

3.3 IDENTIFICATION

A. Materials and their installation are specified in Section 322333: Excavating, Backfilling and Compacting for Utilities. Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.4 DRAINAGE PIPING APPLICATIONS

A. General: Include soiltight joints, except where watertight or silttight joints are indicated.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.

C. Pipes 2 to 4 inches: Cast Iron (CIP) soil pipe and hub fittings or polyvinyl chloride schedule 40 (PVC Sch40) with solvent-cement joints.

D. Pipe Sizes 4 to 12 Inches: ASTM D 3034, polyvinyl chloride (PVC) SDR 35 sewer pipe and fittings; solvent-cemented joints; or with gaskets and gasketed joints.

E. Pipe Sizes 12 to 60 Inches: Reinforced Concrete Pipe (RCP) per SSPWC Section 207-2 or ASTM D3350 OR high-density polyethylene (HDPE) Pipe with corrugated exterior and smooth interior wall. See Drawings for requirement for installation of HDPE with sizes smaller than 12 inches.

F. Special conditions: Drainage pipes under buildings, or under public sidewalks shall be hub and spigot cast iron soil pipe and fittings per ASTM A 74.

3.5 DRAINAGE APPURTENANCES

A. Catch basins, junction chambers, manholes, box culverts, outlet chambers and other drainage structures: Construct as indicated on Drawings and as specified in Section 321313: Site Concrete Work.

3.6 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for non-pressure applications:

   a. Strait-pattern, sleeve type to join piping, of same size, with small difference in outside diameters.

   b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.

   c. Gasket type to join piping of different sizes where annular space between smaller piping's outside diameter and larger piping's inside diameter permits installation.

   d. Internal-expansion type to join piping with same inside diameter.

2. Use pressure-type pipe couplings for force-main, pressure application joints. Include polyethylene (PE) encasement.

B. Special Pipe Fittings: Use where indicated. Include polyethylene (PE) encasement.

C. Watertight catch basin or manhole connections: Watertight "Z-Loc" pipe connector per Jensen Precast or approved equal. Use where indicated for cast-in-place structures.

3.7 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed. Verify existing elevations prior to extensive excavating and notify Engineer of any discrepancies. Contractor shall be liable for any premature construction which must be modified due to unforeseen existing conditions.

C. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited. At pipe size transitions, the pipe soffit line and drop invert.

D. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

E. Join pipes of different sizes centerline to centerline, unless "flat" joint is specified on the drawings.

3.8 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to the following.

B. Install with top surfaces of components, except piping, flush with final finished surface.

C. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: As follows:

1. Join solvent-cement-joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
2. Join pipe and gasketed fittings with elastomeric seals according to ASTM D 2321.
3. Join profile sewer pipe and ribbed drain pipe and gasketed fittings with elastomeric seals according to ASTM D 2321 and manufacturer's written instruction.
4. Install according to ASTM D 2321.

D. System Piping Joints: Make joints using system manufacturer's couplings, except where otherwise specified.

E. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

3.9 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions and as indicated.

B. Assemble and install components according to manufacturer's written instructions, ASME A112.3.1, and as indicated.

C. Install with top surfaces of components, except piping, flush with final finished surface.

D. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

E. Embed channel sections and appurtenances in a 4-inch minimum depth of concrete around bottom and sides, unless indicated otherwise.

F. Fasten grates to channel sections if indicated.

G. Assemble trench drain sections with flanged joints.

H. Embed trench drain sections and appurtenances in a 4-inch minimum depth of concrete around bottom and sides, unless indicated otherwise.

3.10 DRAIN INSTALLATION

A. Install type drains in locations indicated.

B. Embed drains in a 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with final surface of paving.

3.11 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished work conforms as nearly as practical to requirements specified for new work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3,000-psi, 28-day compressive-strength concrete.

C. Make branch connections from side into existing piping, sizes 4 to 20 inches by removing a section of existing pipe and installing a wye fitting into existing piping. Encase entire wye with not less than 6 inches of 3,000-psi, 28-day, compressive-strength concrete.

D. Make branch connections from side into existing piping, sizes 24 inches or larger or to underground structures by cutting an opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for a minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

1. Use concrete that will attain a minimum 28-day compressive strength of 3,000 psi, unless otherwise indicated.
2. Use epoxy bonding compound as an interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 CLOSING ABANDONED DRAINAGE SYSTEMS

A. Demolish, remove and dispose of existing drainage systems slated for demolition, unless specifically indicated to be abandoned in place.

B. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either of the following procedures:

1. Close open ends of piping with at least 8-inch-thick brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

C. Abandoned Structures: Excavate around structure as required and use either of the following procedures:

1. Remove structure and close open ends of remaining piping.
2. Remove top of structure down to at least 36 inches (1000 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to Section 322316: Excavating, Backfilling and Compacting for Structures.

3.13 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and whenever work stops.
3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

B. Video tape interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of the Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visual between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
4. Submit separate reports for each test.
5. Where authorities having jurisdiction do not have published procedures, perform tests as follows:
    a. Storm Drainage: Perform hydrostatic test.
        i. Allowable leakage is a maximum of 200 gallons per inch nominal pipe size, for every mile of pipe, during a 24-hour period.
        ii. Close openings in system and fill with water.
        iii. Purge air and refill with water.
        iv. Disconnect water supply.
        v. Test and inspect joints for leaks.
        vi. Option: Test ductile-iron piping according to AWWA C600, Section 4 "Hydrostatic Testing." Use test pressure of at least 5 psig.
        vii. Option: Test concrete piping according to ASTM C 969 (ASTM C 969M).

viii. Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

b. Storm Drainage: Perform hydrostatic test. Close openings in system and fill with water to not less than 10-foot head of water. Disconnect water supply. Water level must not drop for 15 minutes. Inspect joints for leaks.

c. Storm Drainage: Perform air test according to UNI-B-6.

i. Option: Test round concrete piping, 24 inches and smaller, according to ASTM C 924 (ASTM C 924M).

6. Leaks and loss in test pressure constitute defects that must be repaired.

7. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.14 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.15 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 33 41 00 - STORMWATER POLLUTION PREVENTION PROGRAM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Stormwater Pollution Prevention Program document, prepared on behalf of the Owner by a certified QSD professional and uploaded onto the State SMARTS system by the Owner's Legally Responsible Person with all required Project Registration Documents, Notice of Intent (NOI) filed by the Owner, and a Waste Discharge ID number provided for the project by the State Water Recourses Control Board.

C. State Of California Construction Storm Water Program

Per the State Water Recourses Control Board (SWRCB) all dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit Order 2009-0009-DWQ. as amended by Order 2012-0006-DWQ. Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

D. California Green Building Standards Code

Per 2019 California Green Building Standards (CALGreen) Code SECTION 5.106 Site Development, all dischargers that disturb less than one acre of soil shall comply with 2019 CALGreen Code Subsection 5.106.1 with implementation of Best Management Practices (BMPs) that have been selected specific to this site, conforming to the State Stormwater NPDES Construction Permit 99-08-DWQ or a lawfully enacted local stormwater management and/or erosion control ordinance, whichever is stricter.

1.2 SUMMARY

A. This Section includes general guidelines for preparation, processing, obtaining approvals and implementation, and monitoring of Storm Water Pollution Prevention Program (SWPPP) for the purpose of preventing the discharge of pollutants from the Project site during construction. SWPPP preparation, maintenance, upkeep, and compliance with its mandates and requirements are responsibility of the Contractor.

B. SWPPP has been prepared for this project on behalf of the Owner and it will be provided for implementation to the contractor selected for the construction.

C. SWPPP is a fundamental requirement of stormwater permits, and it:

D. Identifies all potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site

E. Describes practices to be used to reduce pollutants in storm water discharges from the construction site, and

F. Helps assure compliance with the terms and conditions of the permit (when the plan is designed for the individual site, and is fully implemented)

G. SWPPP requires compliance with local, state and federal regulations.

H. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) until the date of Substantial Completion.

I. The work includes implementation of a Storm Water Pollution Prevention Plan (SWPPP) including installation and maintenance of storm water pollution prevention Best Management Practices (BMPs) for erosion control, sedimentation control and housekeeping practices required to control discharges to the storm water conveyance system. These requirements shall apply to all construction related areas and activities associated with the project, such as staging areas, equipment and material storage sites, waste management areas, and borrow pit operations which may be outside the construction limits.

J. Certification that the Project has met all of the conditions of the General Construction Activity Storm Water Permit (GCASP).

1.3 RELATED SECTIONS

A. Section 01 25 13: Product Submittal Procedures
B. Section 01 50 00: Temporary Facilities and Controls
C. Section 01 77 00: Closeout Procedures
D. Section 31 12 00: Site Clearing and Grubbing
E. Section 31 22 00: Grading
F. Section 31 23 00 - Excavating, Backfilling and Compacting for Pavement
G. Section 31 23 16 - Excavating, Backfilling and Compacting for Structures
H. Section 31 23 33 - Excavating, Backfilling and Compacting for Utilities
I. Section 33 41 00 - Stormwater Pollution Prevention
J. Section 31 23 19 – Dewatering

1.4 SWPPP PREPARATION INFORMATION

A. The Project SWPPPP document was prepared in accordance with the Storm Water Pollution Prevention Plan And Monitoring Program Checklist, Construction General Permit Order 2012-0006-DWQ as amended by Order 2012-0006-DWQ, NPDES Permit No. CAS000002, provided by State of California SWRCB to aid preparation of the SWPPP. The Checklist is a comprehensive list of issues a SWPPP preparer must consider during the development of the document. For reference it can be obtained from:

SWRCB, Division of Water Quality
1001 I Street • Sacramento, California 95814 • (916) 341-5537
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
Or online from: http://www.cicacenter.org/pdf/CASWPPPCL.pdf

1.5 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. The list provided below is not intended to be all inclusive of each regulation prevailing over the work. The latest version of the document listed shall govern the work performed.

A. State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ as amended by Order 2012-006-DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, Waste Discharge Requirements (WDR's) for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Storm Water Permit) as amended, and/or modified.

2009-0009-DWQ Construction General Permit (Effective July 1, 2010)

B. California Storm Water Best Management Practices Handbook - Construction, January 2003, published by the California Stormwater Quality Association

(www.cabmphandbooks.com).

C. Caltrans Construction Site Best Management Practices Handbook, March 2003

(www.dot.ca.gov/hq/oppd/stormwtr/).

1.6 PROJECT CONDITIONS

A. A construction site risk assessment has been performed and it has been determined that this is a Risk Level 1 project. Due to the classification of the site as Risk Level 1, a SWPPP will be prepared according to the requirements of Attachment C of the General Permit, which has been attached. The proposed SWPPP will provide BMPs recommendations and requirements and sampling/analysis requirements based on the categorization of the site as a Risk Level 1 project. The Risk Level is based on project duration, location, proximity to impaired receiving waters, and soil conditions.

B. Additionally, the LA Regional Water Quality Control Board is currently developing requirements for construction sites that drain to waterways with defined TMDLs of pollutants. The new regulations are expected to be in effect within next 2 years and may also affect active construction sites with an existing permit under the State Water Resources Control Board. As 303(d) List Impairments have been identified and TMDLs have been established for the project receiving waters, these new requirements would likely affect the scope of this project if adopted prior to the completion of construction. The adoption of such regional-based requirements will likely require changes to the existing SWPPP document or the preparation of a new stormwater document. Changes may affect the requirements for sampling of stormwater for Risk Level 1 project sites.

C. Contractor shall submit the name, title, current certificate, work phone number and emergency phone number for the Contractor's designated QSP person responsible for SWPPP implementation, monitoring and reporting. This person must be available throughout the project and will be responsible for ensuring compliance with requirements of this Construction General Permit This person will also be responsible for notifying the Owner of any non-compliance.

D. Modifications to the SWPPP - Modifications and amendments to the SWPPP shall be made only by the QSD certified preparer, and are subject to the review and approval of the Owner and have to be updated on the State SMARTS system.

1.7 RESPONSIBILITIES OF THE OWNER

A. The Owner will provide the construction SWPPP guidance document.

B. The Owner shall be responsible for maintaining a copy of the NOI, and NOT and other associated Project Registration and Reporting documents in accordance with "Retention of Records" provisions of the General Permit.

C. The Owner's approved Qualified SWPPP Practitioner (QSP) has the authority to limit the surface area of soils exposed by clearing and grubbing, excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary BMPs to minimize pollutant transport. The Owner's approved QSP has the authority to require BMPs to be installed or maintained by the Contractor at any time and to stop or delay work that could result in pollutant transport, until such time as the Contractor provides adequate BMP protection.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the quality, grade, and type of materials as specified in the California Stormwater Quality Association (CASQA) - The Construction Handbook.

B. The contractor shall have adequate materials on site to quickly deploy BMPs to protect the exposed portions of the site and to prevent sediment and pollutant discharges from the site.

C. Erosion control BMPs may include but are not limited to: scheduling, slope roughening, preservation of existing vegetation, hydraulic mulches, temporary seeding, soil stabilizers and binders, bonded fiber matrix (BFM), erosion control blankets, and plastic covers. Temporary sediment control BMPs may include but are not limited to linear sediment barriers (e.g., silt fence, fiber rolls, gravel bag berms), sediment traps, storm drain inlet protection, tracking controls, and dust control. Non-storm water management BMPs may include but are not limited to: pavement cutting, vehicle and equipment cleaning, vehicle and equipment fueling and maintenance. Materials and Waste Management BMPs may include but are not limited to: material storage, stockpiles, spill prevention and control, clean up, and concrete waste management.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with all provisions of the State Water Resources Control Board, National Pollutant Discharge Elimination System (NPDES), General Permit No. Cas000002, including requirements to collecting and analyzing storm water samples for non-visible pollutants and sediment/siltation, as described in the permit and as applicable to the project.

B. Allowable Non-Storm Water Discharges: In accordance with the General Permit, the
following non-storm water discharges to the storm drain system (including canyons and creeks) are allowable upon the condition that the discharges do not cause or contribute to the violation of any Plan Water Quality objective and are not a significant source of pollutants:

1. Water line flushing and other discharges from potable or raw water supply sources
2. Landscape irrigation and lawn watering
3. Rising ground waters or springs
4. Uncontaminated pumped groundwater not subject to any applicable NPDES permit
5. Passive foundation and footing drains
6. Water from crawl space pumps
7. Air conditioning condensation
8. Non-commercial and residential washing of vehicles
9. Flows from riparian habitats and wetlands
10. Dechlorinated swimming pool discharges
11. Flows from fire fighting

To assure that allowable non-stormwater discharges do not become a significant source of pollutants, the Contractor's SWPPP amendments must identify the BMPs that will be implemented to control the discharge. The purpose of such BMPs is to prevent the allowable non-stormwater discharges from picking up and conveying pollutants from sources that may be in the

discharge flow path. Additionally, wherever feasible, alternatives that would not result in discharge of allowable non-stormwater discharges should be implemented.

C. Prohibited Non-Storm Water Discharges: All other discharges to the storm drain system are prohibited including but not limited to: process and wash waters, dust, petroleum products, soil or sediment, litter or debris, paint or other construction-related wastes or materials. The Contractor shall be responsible for clean-up, mitigation, and penalties resulting from failure to implement and maintain appropriate BMPs for pollution prevention.

3.2 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Provide the quality, grade, and type of materials as specified in The California Stormwater Quality Association (CASQA) - The Construction Handbook.

3.3 SWPPP DOCUMENT DETAILS

In accordance with the Construction General Permit requirements for development and implementation of a Storm Water Pollution Prevention Plan (SWPPP):

A. The SWPPP will contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP will list Best Management Practices (BMPs) to be implemented in order to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP will contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented in case of a BMP failure; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment. Section A of the Construction General Permit describes the elements that must be contained in a SWPPP.

B. Owner will prepare a permit application containing all required Project Registration Documents (PRDs), and submit the application and application fee to the State Water Resources Control Board. Contractor shall reimburse the Owner for the fees.

C. Storm water multiple application and report tracking system - SMARTS! The storm water program is responsible for processing PRDs, reviewing, updating, terminating notices of intent (NOIs), annual reports, and maintaining the billing status of each discharger.

SMARTS has been developed to provide an online tool to assist dischargers in submitting their NOIs, NECs, NOTs, and Annual Reports, as well as, viewing/printing Receipt Letters, monitoring the status of submitted documents, and viewing their application/renewal fee statements. The system will also allow the Regional Board and State Board staff to process and track the discharger submitted documents.

D. Owner will submit all required PRD and pay fees prior to the beginning of construction and process the NOI and issuing the WDID number. No construction shall be done prior to issuance of a formal WDID number for the project.

E. Where land disturbance is less than one (1) acre, preparation and uploading of a State SWPPP on the SMARTS system is not required, however any non-residential project is required to implement BMPs indicated in the CASQA BMP Handbook to prevent or minimize storm water pollution as specified in the 2012 CalGreen Code.

F. The SWPPP for this project will describe:

1. The project location, site features, and materials/activities that may result in the off-site discharge of pollutants during construction.

2. Controls to be implemented during construction - BMPs selected to control erosion, the discharge of sediment, and other pollutant sources.

3. Inspection and maintenance program for BMPs.

4. Sampling and analysis plan for sediment discharges to impaired water bodies as well as a plan to sample for non-visible pollutants.

5. Post construction controls – BMPs to prevent or control pollutants in runoff after construction is complete, including long-term maintenance.

G. Contractor shall keep a copy of the SWPPP on the site; implement it during construction and request revisions from the QSD, as needed to reflect all phases of construction.

H. The QSP for the project shall Submit Notice of Termination (NOT) when construction is complete and conditions of termination listed in the NOT have been satisfied

3.4 IMPLEMENTATION

A. Install perimeter controls prior to starting Work at the Project site.

B. Contain on-site storm water on the Project site. Do not drain on-site water directly into the storm drain.

C. Designate trained personnel for the proper implementation of the SWPPP.

D. Request revisions to the SWPPP to suit changing Project site conditions and also when properly installed systems are ineffective.

E. Upon Substantial Completion:

1. Leave storm water pollution prevention controls in place when required for post-construction storm water management and remove those that are not needed as determined by Agency. Owner will maintain prevention controls left in place.

2. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certifications and related documents to Owner. Post-construction storm water operation and the management plan as mentioned in the compliance certifications are considered to be in place at Final Completion.

3.5 IMPLEMENTATION OF STORM WATER BMPs.

A. The Contractor shall implement appropriate BMPs to prevent and/or control potential discharges and to protect the storm water conveyance system from any and all activities with the potential to release materials directly or indirectly into the storm water conveyance system.

B. Details and working drawings for BMPs are provided in the references listed in this Section. The Contractor shall provide an effective combination of Erosion and Sediment control BMPs, Non-Storm Water Management BMPs, and Materials and Waste Management BMPs.

C. Implement SWPPP as submitted per this Section.

3.6 TRAINING

A. Contractor shall ensure that training on this special condition is given to all employees and subcontractors involved in construction activities. This training shall include but not be limited to the location of the storm drains on the job site; the direct link between the storm drain system and the bay; potential pollutants; and BMP installation, inspection, maintenance and repair.

3.7 NOTIFICATION

A. The Contractor shall notify the Owner's QSP and/or Construction Manager immediately of any unauthorized releases to the storm drain. The Contractor shall immediately document all unauthorized releases including but not limited to the time, date and duration, material released, and action taken to stop discharge and prevent future discharges. Documentation shall be provided to the Owner and included in the Contractor's amended SWPPP.

3.8 MAINTENANCE, INSPECTION, AND REPAIR OF BMPs

A. The Contractor shall follow the written instructions provided by the project QSP.

B. The Contractor shall inspect BMPs before predicted rain events, and after rainfall. For prolonged events, greater than 24 hours, the Contractor shall inspect BMPs during the rain storm.

C. The Contractor shall inspect BMPs in accordance with procedures identified in the references identified in this Section.

D. The Contractor shall closely examine each BMP for 1) structural integrity; 2) sediment accumulation greater than 1/3 total depth; 3) evidence of excessive sediment downstream of BMPs or the site; and 4) evidence of other construction materials washed off-site.

E. If a selected BMP fails or requires maintenance, it shall be maintained, repaired, modified, or replaced with an acceptable alternate as soon as it is safe to do so.

3.9 MONITORING

A. the QSP shall conduct examination of pollution prevention controls on a by-weekly basis, as well as before and after each storm and each day during extended storm events. QSP will prepare and maintain, at the Project site, a log of each inspection using Site Monitoring Report forms. QSP will report to RWQCB within the time required by the law, if non-compliance has been identified.

3.10 LIABILITIES AND PENALTIES

A. Review of the SWPPP and inspection log by Owner shall not relieve Contractor from liabilities arising from non-compliance of storm water pollution regulations.

B. Payment of penalties for non-compliance by Contractor shall be the sole responsibility of the Contractor.

C. Compliance with the Clean Water Act pertaining is the sole responsibility of Contractor. Any fine against Owner due to non-compliance by Contractor, Owner shall recover all costs of the fine by appropriate assessment.

3.11 CHANGE OF INFORMATION

A. Submit to Owner completed NOI Form for change of information (Construction Site Information and Material Handling/Management Practices).

3.12 ATTACHMENTS

A. Construction General Permit, Attachment C - Risk Level 2 Requirements.

END OF SECTION

SECTION 33 51 00 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for natural gas distribution outside the building:
   1. Piping.
   2. Valves.

B. Related Sections include the following:
   1. Division 15 Section for HVAC piping inside the building.

1.3 DEFINITIONS

A. Gas Main: Utility's natural gas piping.

B. Gas Distribution: Piping from gas main to individual service-meter assemblies.

C. Point of Delivery: Piping outlet from service-meter assembly.

D. Natural Gas Piping: Piping that conveys natural gas from point of delivery to natural gas utilization devices inside the building.

E. PE: Polyethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Ratings:
   1. Piping and Valves: 100 psig (690 kPa) minimum, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. PE pipe and fittings.
   2. Valves.

B. Shop Drawings: For natural gas service piping and service meter assembly. Include plans, elevations, sections, details, and attachments to other work.

C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of valves and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Comply with requirements of utility supplying natural gas and with authorities having jurisdiction for natural gas systems.

C. Comply with NFPA 54 for materials, installation, testing, inspection, and purging.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle liquids to avoid spillage and ignition. Notify gas supplier. Do not leave flammable liquids on premises overnight.

B. Preparation for Transport: Prepare valves for shipping as follows:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends, flange faces, and weld ends.
3. Set valves in the best position for handling. Set valves closed to prevent rattling.

C. Storage: Use the following precautions for valves during storage:

1. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors and maintain a temperature higher than ambient dew point temperature. Support valves off the ground or pavement in watertight enclosures when outdoor storage is necessary.

D. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

E. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent damage and entrance of dirt, debris, and moisture.

F. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when stored inside.

G. Protect flanges, fittings, and piping specialties from moisture and dirt.

H. Store PE pipes and valves protected from direct sunlight. Support pipes to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Verify that natural gas distribution systems piping may be installed in compliance with original design and referenced standards.

C. Site Information: Subsurface conditions were investigated during design of Project. Reports of these investigations are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy continuity of conditions (between soil borings). District assumes no responsibility of interpretations or conclusions drawn from this information.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate connection to gas main with utility company.

B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building natural gas piping systems.

C. Coordinate with other utility work.

D. Notification of Interruption of Service: Notify each affected user when gas supply will be turned off.

E. Work Interruptions: Leave natural gas distribution systems in a safe condition when interruptions in work occur while alterations or repairs are being made to existing gas piping systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Gas Valves, 2 Inches (50 mm) and Smaller:
   a. Homestead by Olson Technologies, Inc.
   b. Lancaster by National Meter Parts, Inc.
   c. Lunkenheimer Co.
   d. A.Y. McDonald Mfg. Co.
   e. Milliken Valve Co., Inc.
   f. Mueller Co., Grinnell Co.
   g. Mueller Steam Specialty Div., Core Industries, Inc.
   h. Nordstrum Valves, Inc.
   i. Resun by J.M. Huber Corp., Equipment Div.
   j. Rockford-Eclipse Div., Eclipse, Inc.
2. Plastic Gas Valves:
   a. Kerotest Manufacturing Corp.
   b. Perfection Corp., Gas Products Div.

2.2 PIPES AND FITTINGS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket type or ASTM D 3261, butt type with dimensions matching ASTM D 2513, SDR 11, PE pipe.
2. Transition Fittings: Type, material, and with end connections matching piping being joined.

2.3 JOINING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for joining materials required for each system.

B. Threaded-Joint Compound and Tape: Suitable for natural gas.

C. Plastic-Pipe, Fusion-Joint Procedure: According to plastic pipe and valve manufacturers' written instructions.

D. Plastic-Pipe, Flanged-Joint Gasket Material, Bolts, and Nuts: Type and material recommended by piping system manufacturer for natural gas service, except where other type or material is indicated.

2.4 VALVES

A. Manual Valves: Conform to standards listed, or where appropriate, valves according to ANSI Z21.15 and ANSI Z21.15a are acceptable.

B. Gas Valves, 2 Inches (50 mm) and Bigger: 125 psig (1035 kPa) WOG minimum, equivalent to ASME B16.33, lubricated, straightaway pattern, cast-iron or ductile-iron body. Include tapered plug, O-ring seals, square or flat head, and threaded ends.

1. Option: Include locking (tamperproof) device feature.

C. Plastic Gas Valves: ASME B16.40, polyethylene (PE), SDR 11.

D. Valves for connection to existing gas mains include fittings that are compatible to the existing main and new branches. Pressure rating is 125 psig (860 kPa) minimum.

E. Valve Boxes: Cast-iron 2-section box. Top section includes cover with "GAS" lettering. Bottom section includes base of size to fit over valve and barrel approximately 5 inches (125 mm) in diameter. Valve box includes adjustable cast-iron extension of length required for depth to bury valve.

1. Furnish 1 steel operating wrench with each valve box. Include tee-handle with 1 pointed end, stem of length required to operate valve, and socket fitting valve-operating nut.

2.5 IDENTIFICATION

A. Equipment Nameplates: Metal nameplate with operational data engraved or stamped and permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible.

B. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style in sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch (1.6 mm), for units up to 20 square inches (0.25 sq. m) or 8 inches (200 mm) long; 1/8 inch (3.2 mm) for larger units.
5. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

C. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches (150 mm) wide by 4 mils (.01 mm) thick, solid yellow color with continuously printed caption in black letters "CAUTION - GAS LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off gas to premises or piping section.

B. Inspect natural gas piping according to fuel gas code to determine that natural gas utilization devices are turned off in piping section affected.

C. Comply with fuel gas code requirements for prevention of accidental ignition.

3.3 PIPING APPLICATIONS

A. Flanges, unions, and transition and special fittings with pressure ratings same as or higher than system pressure rating may be used, unless otherwise indicated.

B. Underground Piping: PE pipe, PE fittings, and heat-fusion joints.

C. Protective Conduit for Underground Piping: Steel pipe and threaded- or welding-type fittings.

D. PE-to-Steel Piping Connections: Transition fitting.

3.4 VALVE APPLICATIONS

A. Use gas valves of sizes indicated for gas service piping, meters, mains, and where indicated.

B. Use plastic gas valves on plastic gas distribution piping. Install on buried piping with valve box.

C. Use valve and fitting assemblies made for tapping gas mains for connections to existing gas mains.

3.5 JOINT CONSTRUCTION

A. Use materials suitable for natural gas service.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

1. Note the internal length of threads in fittings or valve ends and proximity of internal seat or wall to determine how far pipe should be threaded into joint.
2. Apply tape or thread compound to external pipe threads.
3. Align threads at point of assembly.
4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.

5. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

C. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

D. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to pipe manufacturer's printed instructions.

1. Plain-End Pipe and Fittings: Butt joining.

2. Plain-End Pipe and Socket-Type Fittings: Socket joining.

E. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions, in piping 2 inches (50 mm) and smaller, adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50 mm) or smaller threaded pipe connection.

2. Install flanges, in piping 2-1/2 inches (65 mm) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

3.6 PIPING INSTALLATION

A. Install underground, natural gas distribution piping buried at least 24 inches (600 mm) below finished grade.

B. Install underground, PE, natural gas distribution piping according to ASTM D 2774.

C. Install underground, PE, natural gas distribution piping at entrance to and under part of building in steel piping protective conduit that is vented to outside.

D. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

3.7 VALVE INSTALLATION

A. Install PE shutoff valves on branch connections to existing underground, natural gas distribution piping. Install valves with valve boxes.

3.8 CONNECTIONS

A. Extend and connect natural gas distribution piping to gas source and to the building. The building's natural gas systems are specified in Division 15 Section "HVAC Piping"

1. Terminate gas distribution system piping at building wall until building's natural gas piping systems are installed. Terminate piping with caps, plugs, or flanges, as required for

piping material. Make connections to building's gas systems when those systems are installed.

B. Connect to utility company gas main according to utility company's procedures and requirements.

C. Connect to existing gas main according to ASME B31.8.

3.9 ELECTRICAL BONDING AND GROUNDING

A. Install aboveground portions of natural gas piping systems that are upstream from equipment shutoff valves, electrically continuous, and bonded to grounding electrode according to NFPA 70.

B. Do not use gas piping as a grounding electrode.

3.10 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter, and earthquake valve.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

B. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape over natural gas distribution piping during backfilling of trenches for piping.

C. Refer to Division 2 Section "Earthwork" for warning tapes.

3.11 PAINTING

A. Refer to Division 9 Section "Painting" for field-applied finishes.

B. Paint exposed metal piping, valves, service regulators, service meters and meter bars, and piping specialties except units with factory-applied paint or protective coating.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas distribution according to requirements of fuel gas code and utility.

B. Repair leaks and defective valves and specialties and retest system until no leaks exist.

C. Report results in writing.

D. Verify correct pressure settings for service regulators.

END OF SECTION