PROJECT MANUAL AND SPECIFICATIONS
FOR
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
LEONARDO DaVINCI TK CLASSROOM

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(To be provided and edited by the Construction Manager and District)

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SACRAMENTO CITY UNIFED SCHOOL DISTRICT

LEONARDO DaVINCI K-8 SCHOOL
TK CLASSROOMS

4701 JOAQUIN WAY
SACRAMENTO, CA 95822

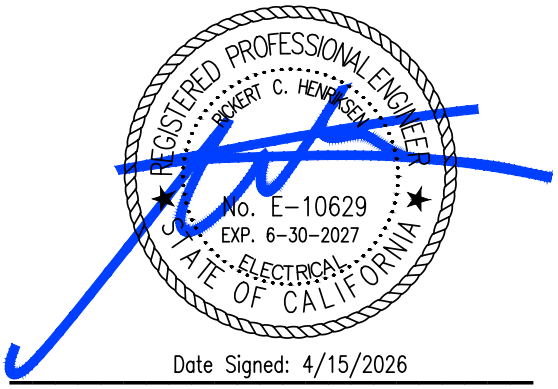
CONSULTANT STAMPS



AOR



MEOR



Date Signed: 4/15/2026

EEOR

SECTION 02 41 00

SELECTIVE SITE DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00 - Construction Facilities and Temporary Controls.
3. Section 01 50 13 - Construction Waste Management and Disposal.
4. Section 31 00 00 - Earthwork.

1.02 REGULATORY REQUIREMENTS

A. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.

B. Coordinate clearing Work with utility companies

C. Maintain emergency access ways at all times.

D. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.03 SUBMITTALS:

A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.

B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.04 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

1.05 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Safety Precautions Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.

1. Protect existing items which are not indicated to be altered. Protect utilities designated to remain from damage.
2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on drawings.
3. Protect benchmarks from damage or displacement.

D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

E. Fire Safety: The contractor shall conform to chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition”, at all times during the construction process. A copy of this chapter can be provided.

F. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

G. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

H. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions of work in place before beginning work, report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.02 PREPARATION

A. Scheduling:

1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.

B. Hazardous Materials:

1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.

C. Utility and Service Termination

1. Locate and identify existing utility, service and irrigation system components affected by work of this contract. Review existing record drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
2. Prior to beginning any demolition, properly disconnect all water, gas and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this contract.
4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project Record Documents.

D. Verify that existing plant life and features designated to remain are tagged or identified.

1. The Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by the Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.03 DEMOLITION

A. General Requirements

1. Clear areas required for access to site and execution of Work, including pavements, structures, foundations, vegetation, trash and debris.
2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.
6. See list below for other site specific buildings, structures, equipment that need to be walked with District prior to demolition for items to be salvaged:
   a. K-2 Building

3.04 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts and similar components.

1. Review all contract documents showing crossing paths and potential points of interference.
2. Pothole or determine by other means the accurate depth and location of such utilities.
3. Incorporate all costs required to complete work under this contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this contract.
4. No additional cost to the Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on contract drawings or can be reasonably inferred from surface conditions or components.

B. Remove all conductors from conduit at all abandoned electrical circuits.

C. Seal off ends of all piping, drains and other components as directed by Architect and serving utility.

D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components.

1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.
3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets and piping. Fine grade to maintain proper drainage flow pattern to drains.

3.05 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove concrete paving and curbing at locations shown on drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove paving assembly as required to expose subgrade.

3.06 DISPOSAL

Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

A. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.

B. It is recommended that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).

C. Burning and Burying of Materials: NOT ALLOWED.

D. Haul Routes:

1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance, post flagmen for the safety of the public and workmen.
2. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

E. Remove demolished materials and debris from site on a daily basis.

3.07 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris.

B. Clean excess material from surface of all remaining paved surfaces and utility structures.

C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

SECTION 02 41 19

SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Demolition of non-structural items in an existing classroom.

2. Demolition of roof top equipment and modifications to roof for new units.

B. Related Requirements:

1. Section 02 41 00 "Site Demolition" for partial demolition of buildings, structures, and site improvements.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store. Include fasteners or brackets needed for reattachment elsewhere.

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.

2. Review structural load limitations of existing structures.

3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review and finalize protection requirements.

5. Review procedures for noise and dust control.

6. Review procedures for protection of adjacent buildings.

7. Review items to be salvaged and returned to Owner.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, which indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

D. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.

2. Temporary interruption of utility services.

3. Shutoff, capping or re-routing of utility services.

E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.07 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.08 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.09 FIELD CONDITIONS

A. Buildings to have demolition will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.

2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before demolition, Owner will remove the following items:

a. Furniture and rugs
b. Supplies from storage rooms
c. Book shelves shall be emptied and decorative or educational items shall be removed from walls.

E. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

F. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped as needed before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.03 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.04 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving area of demolition.

1. Owner will arrange to shut off utilities when requested by Contractor.

2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

3.05 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.

1. Protect adjacent buildings and facilities from damage due to demolition activities.

2. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

3. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

4. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.

D. Remove temporary barriers and protections where hazards no longer exist.

3.06 DEMOLITION, GENERAL

A. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Explosives: Use of explosives is not permitted.

3.07 DEMOLITION BY MECHANICAL MEANS

A. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Salvage: Items to be removed and salvaged are indicated on Drawings.

1. Doors and door hardware.

2. Projector Screens.

3. Tackboards.

4. Marker boards.

5. Plumbing fixtures.

3.09 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.11 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior non-load-bearing wall framing, for framing that exceeds the height limitations of standard, nonstructural metal framing

B. Related Requirements:

1. Section 08 11 00 – Metal Frames
2. Section 09 29 00 – Gypsum Board

1.03 SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials
2. Interior non-load-bearing wall framing
3. Double deflection track
5. Power-actuated anchors

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA).

1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally licensed as either a Structural or Civil Engineer in the State of California. Engineering services are

defined as those performed for installations of cold-formed steel framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E329 for testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the SFIA.

F. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

G. Fire-Test-Response Characteristics: Where indicated, provide cold-formed steel framing identical to that of assemblies tested for fire resistance per ASTM E119 by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.

H. Comply with the following AISI specifications and standards:

1. AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members."
2. AISI S200, "North American Standard for Cold-Formed Steel Framing - General Provisions."
3. AISI S201, "North American Standard for Cold-Formed Steel Framing - Product Standard."
4. AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."
5. AISI S240, "North American Standard for Cold-Formed Steel Structural Framing."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide cold-formed steel framing products by ClarkDietrich; as specified in other Part 2 articles or comparable product by one of the following current members of the SFIA:

1. Scafco Corp.
2. Steeler Construction Supply
3. Telling Industries

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in 1.04-B above, to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated. Loading shall account for grab bars, plumbing fixtures, doors, etc.

1. Design Loads: As required by codes.

2. Deflection Limits: Design framing systems to withstand fixtures and equipment dead loads and user imposed live loads without deflections greater than the following:
   a. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
   b. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1/2 inch (13 mm).

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100 and ASTM C955.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.03 COLD-FORMED STEEL FRAMING MATERIALS

A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C955 for conditions indicated.

C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST33H (ST230H)

2. Coating: G90

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   a. Minimum Base-Steel Thickness: 0.0329 inch (0.84 mm)
   b. Flange Width: 1 inch (25 mm) plus twice the design gap for multi-story buildings.

2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Steel Thickness: 0.0329 inch (0.84 mm)
   b. Flange Width: 1.5 inches

PART 3 – INSTALLATION
NOT USED

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Fiber Glass thermal and acoustical insulation (Formaldehyde-Free Fiberglass Insulation).

B. Related Sections:

1. Division 7 Section: Joint Sealants.
2. Division 9 Section: Gypsum Board.
3. Division 23 Section: Mechanical: Duct insulation and Pipe insulation.

1.2 REFERENCES

A. ASTM International:

1. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
2. ASTM C356 Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.
3. ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
4. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
7. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
8. ASTM C764 Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.
9. ASTM C991 Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings
10. ASTM C1014 Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation.
11. ASTM C1015 Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.
12. ASTM C1104 Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
13. ASTM C1149 Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation
14. ASTM C1304 Standard Test Method for Assessing the Odor Emission of Thermal Insulation

Materials.

15. ASTM C1320 Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
16. ASTM C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
17. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
19. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
20. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
21. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
22. ASTM E736 Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
23. ASTM E759 Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
24. ASTM E970 Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

B. Performance Requirements: Provide Products/systems that have been manufactured, fabricated and installed to the following criteria:
   1. Surface Burning Characteristics, Unfaced (ASTM E84): Flamespread index 25, smoke developed 50.
   2. Recycled Glass Content: 30% post-consumer.
   3. Combustibility (ASTE136): Noncombustible.
   4. Formaldehyde Content: Free of formaldehyde.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with Sacramento County Standard Specifications and contract.

B. Product Data: Submit manufacturer's product data and installation instructions, including manufacturer's SPEC-DATA® sheets.

C. Samples: Submit manufacturer's standard selection and verification samples
.

D. Quality Assurance/Control Submittals: Submit the following:
   1. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Obtain each type of building insulation through a single source.

B. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

1.5 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

PART 2 PRODUCTS

1.1 FORMALDEHYDE-FREE™ BUILDING INSULATION

A. Basis of Design Manufacturer: Johns Manville.

1. Contact: 717 17th Street 80202, Denver, CO 80217-5108; Telephone: (303) 978-2434; E-mail: Jeffrey.job@jm.com; website: www.JM.com.

B. Fiber glass building insulation:

1. JM Formaldehyde-free™ Unfaced Batts: (interior wall sound insulation)
   a. Thermal Resistance (R-Value) (ASTM C518): R-11
   b. Combustion Characteristics (ASTM E136): Pass.
   c. Critical Radiant Flux (ASTM E970): Greater than 0.11 Btu/ft^2 × s (0.12 W/cm^2).
   d. Water Vapor Sorption (ASTM C1104): 5% or less.
   e. Odor Emission (ASTM C1304): Pass.
   f. Corrosiveness (ASTM C665): Pass.
   g. Fungi Resistance (ASTM C1338): Pass.
   h. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 30% post-consumer on average of manufacturer's products.
   i. GREENGUARD GOLD Certification.
   j. Thickness: [Specify thickness.].
   k. Flamespread (ASTM E84): 25, maximum.
   l. Smoke Developed (ASTM E84): 50, maximum.
   m. Material Standard: ASTM C665, Type I.

2. JM Formaldehyde-free™ Unfaced Batts: Roof Thermal Insulation, Cathedral Application
   a. Thermal Resistance (R-Value) (ASTM C518): R-30
   b. Combustion Characteristics (ASTM E136): Pass.
   c. Critical Radiant Flux (ASTM E970): Greater than 0.11 Btu/ft^2 × s (0.12 W/cm^2).

d. Water Vapor Sorption (ASTM C1104): 5% or less.

e. Odor Emission (ASTM C1304): Pass.

f. Corrosiveness (ASTM C665): Pass.

g. Fungi Resistance (ASTM C1338): Pass.

h. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 30% post-consumer on average of manufacturer's products.

i. GREENGUARD GOLD Certification.

j. Thickness: [Specify thickness.].

k. Flamespread (ASTM E84): 25, maximum.

l. Smoke Developed (ASTM E84): 50, maximum.

m. Material Standard: ASTM C665, Type I.

2.3 PRODUCT SUBSTITUTIONS:

A. Substitutions: Per Sacramento City USD Div 1 specifications.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the building insulation manufacturer.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Verify that site conditions are acceptable for installation of building insulation.
2. Do not proceed with installation of building insulation until unacceptable conditions are corrected.

3.3 PREPARATION

A. Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.4 INSTALLATION

A. General: Comply with insulation manufacturer's written instructions applicable to products and application indicated.

1. Install insulation that is undamaged, dry and unsoiled and that has not been left exposed at any time to ice and snow.
2. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.
3. Water Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
4. Apply single layer of insulation to produce thickness indicated, unless multiple layers are

otherwise shown or required to make up total thickness.

B. Installation of General Building Insulation:

1. Seal joints between closed-cell (non-breathing) insulation units by applying adhesive, mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic or sealant as recommended by insulation manufacturer.

2. Install glass-fiber blankets in cavities formed by framing members according to the following requirements:

   a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

   b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

   c. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

4. Wood-Framed Construction: Install mineral-fiber blankets in accordance with ASTM C1320 and as follows:

   a. With faced blankets having stapling flanges, secure insulation by friction fit inset or face stapling flanges to sides of framing members.

   b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

5. Acoustical Insulation Installation: Install insulation where indicated in sound rated assemblies. Maintain acoustical rating of assembly.

3.5 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site. Repair damage to installed products prior to installation of finish materials.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 SUMMARY

A. All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specification sections which apply to work of this section as if printed herein.

B. Section Includes:
   1. Flashings, counter flashings, and copings as indicated on the Drawings and specified herein.

C. Related Sections:

   1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
   2. Section 07 90 00 – Joint Sealants.
   3. Division 23 - HVAC

1.02 REFERENCES

A. Fabricate sheet metal items from sheet steel in accordance with ASTM G90-23.

B. ASTM A924-22a - General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.

C. FS TT-C 494B – Federal Specification for Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. SMACNA - Architectural Sheet Metal Manual, current edition.

E. AWS - American Welding Society.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate locations, configurations, jointing methods, welding methods, fastening methods, expansion joint layouts, downspout layout and installation details.

C. Samples: Submit two samples, 12 inches long illustrating component design, finish, color, and configuration.

1.04 QUALITY ASSURANCE

A. Conform to SMACNA Manual for architectural sheet metal flashing and installation details.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Where general flashing pieces are shown on drawings, provide steel sheet metal of at least 22-gauge steel unless otherwise noted on drawings.

B. Galvanized Steel: .336-inch thick (22 gauge) ASTM A924 -09a, Grade A, G90 zinc coating.

2.02 ACCESSORIES

A. Fasteners and Clips: Provide as required and appropriate for the materials being fastened. Where fasteners or clips may be exposed to outside weather conditions, provide galvanized or stainless-steel type.

1. Provide fasteners such as bolts, screws, and nails hot-dip galvanized as specified in accordance with ASTM A153-23.

B. Where rivets will be used, provide malleable iron type with rust-inhibitive coating.

C. If drive pins are incorporated into work, provide Omark or other approved, cadmium plated with neoprene facing, at least 1-inch long, with neoprene washers.

F. Bituminous Coating: SSPC – Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

G. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.

H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 90 00 Joint Sealers.

I. Epoxy Seam Sealer: Two-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

K. Paper Slip Sheet: 5 lbs. rosin-sized building paper.

L. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E154-08a(2025).

M. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.

N. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

2.03 FABRICATION

A. General Metal Fabrication:

1. Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
2. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed seams with epoxy seam sealer; rivet joints for additional strength where required.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, in edges to be seamed, form seams and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weather/waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from incompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed for extruded aluminum joint covers. Fabricate mitered and welded corner units.

2.04 PREFABRICATED SHEET METALS

A. All other flashing: Provide minimum 22-gauge galvanized flashing to the sizes and shapes as detailed on the drawings. All exposed flashing shall be primed and painted per the paint specification sections. Provide minimum two (2) coats of paint.

PART 3 – EXECUTION

3.01 PREPARATION

A. Inspect substrate conditions prior to installation of sheet metal items. Conditions which could be detrimental to correct and proper installation of sheet metal assemblies are to be called to the attention of the Owner for their disposition prior to sheet metal work being installed.

B. Coordinate fabrication and installation of sheet metal items with work of others such as roofing, curtainwall and windows, sealants, mechanical and electrical.

3.02 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, finish reglets to trades of masonry work, for installation as work of Division 4 sections.

E. Install counter flashings in reglets, either by snap-in seal arrangement or by welding in-place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated in depending on degree of sealant exposure.

F. Flash around exterior openings in the building where other waterproofing methods are insufficient.

G. Joints

1. Typically, provide flat locked joints with sealant between metal surfaces, unless shown otherwise. Where standing seams are required, provide with folded corners.
2. Provide minimum of 3-inch laps.
3. Where concealed joints are possible, provide flat locked joints with 3-inch reinforcing behind, set-in full bed of sealant.
4. Do not leave sheet metal joint unsealed. See sealant section of these specifications.

3.03 INSPECTION

A. Immediately following installation of sheet metal work, touch-up areas where primer has been removed during installation operations and where soldering has occurred.

B. Where architectural coatings are provided, touch-up marred or abraded finishes with compatible coating which can be expected to provide the same serviceability as factory applied coatings.

3.04 CLEANING

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

3.06 PROTECTION

A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDE

1. Preparing sealant substrate surfaces.
2. Concrete Joint Sealants.
3. Sealant and backing.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 00 72 13: General Conditions.
3. Section 07 60 00: Flashing and Sheet Metal: Sealants used in conjunction with metal flashings.
4. Section 08 11 00: Metal Doors and Frames: Perimeter sealants.
5. Section 09 29 00: Gypsum Board Systems.
6. Division 22: Mechanical.
7. Division 26: Electrical.
8. Section 32 16 00: Site Concrete.

C. REFERENCES

1. ASTM C834-17(2023) Standard Specification for Latex Sealants.
2. ASTM C920-18(2024) Standard Specification for Elastomeric Joint Sealants.
3. ASTM E84-24 Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E119-03a(2023)e1 Standard Test Methods for Fire Tests of Building Construction and Materials.
5. ASTM E814-24 Standard Test Method for Fire Tests of Penetration Firestop Systems.
6. FM (Factory Mutual) - Fire Hazard Classifications.
7. UL - Fire Hazard Classifications.
8. UL 263 – Standard for Fire Tests of Building Construction and Materials.
9. UL 723 - Test for Surface Burning Characteristics of Building Materials.
10. UL 1479 - Fire Tests of Through-Penetration Firestops.
11. FS TT S 00227 Sealing Compound: Elastomeric Type, Multi-Component.
12. FS TT S 00230 Sealing Compound: Elastomeric Type, Single Component.
13. FS TT S 001543 Sealing Compound, Silicone Rubber Base.

1.02 SUBMITTALS

A. Submit manufacturer’s product data under provisions of Section 01 33 00 for each product required.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.

D. Submit standard color ranges of exposed materials for Architect selection.

E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.

B. Applicator: Company specializing in applying the work of this section with minimum three years' experience, with projects of a similar size and type.

C. Conform to Sealant Waterproofing and Restoration Institute requirements for materials and installation.

D. Prior to installation of joint sealants, field test adhesion to joint substrates.

1. Install joint sealants in 5-foot joint lengths. Allow to cure before testing. Test adhesion by pulling sealant out of joint.
2. Perform field tests for each type of elastomeric sealant and joint substrate.
3. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
4. 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.
5. 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 substrate during testing.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

C. Do not install sealants under adverse weather conditions or when temperatures are above or below manufacturer's recommended limitations for installation.

D. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with all Sections referencing this Section.

1.06 WARRANTY

A. Provide two-year warranty for materials and workmanship under provisions of Section 01 33 00.

B. Warranty: Include coverage of installed sealants and accessories which fail to achieve airtight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 – PRODUCTS

2.01 SEALANTS

A. Silicone Sealant: Silicone Sealant (use at concrete, masonry, or glazing applications): FS TT S 01543, Class A, low modulus type; Spectrum I as manufactured by Tremco, Inc.

B. Interior Building Sealant: Acrylic-emulsion; one-part, non-sag, mildew-resistant. Complying with ASTM C834-17(2023), formulated to be paintable; Pecora Corp. “AC-20”, Sonneborn “Sonolac”, Tremco Inc. “Tremco Acrylic Latex 834” or approved equal.

C. Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920-18(2024) Type S; Grade NS Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic file, showers, sinks and plumbing fixtures; Dow Corning Corp. “786 Mildew Resistant”, or approved equal.

D. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, non-skinning, non-staining, gun-able, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound; Pecora Corp. “BA-98”, Tremco Inc. “Tremco Acoustical Sealant” or approved equal.

E. Acoustical Sealant for Exposed Joints: Nonoxidizing, skin-able, paintable, gun-able sealant recommended for sealing interior exposed joints to reduce transmission of airborne sound; Pecora Corp. “AC-20”, USG “Sheetrock Acoustical Sealant” or approved equal.

F. Concrete Expansion Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be chosen from the full range of manufacturer’s standard colors.

G. Sheet Metal Flashings, Trims, Gutters, & Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be chosen from the full range of manufacturer’s standard colors. Provide Sikaflex 260 Primer at all stainless steel and/or galvanized substrate location for proper adhesion of Sikaflex 2cSL.

H. Substitutions: Under provisions of Section 01 33 00.

I. Color of sealant shall be as selected by Architect.

2.03 ACCESSORIES

A. Primer: Non staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Noncorrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Non-staining; compatible with sealant and primer; such as round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Sealant shall not adhere to back-up material.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Solvents: cleaning agents or other accessory materials shall be as recommended by the sealant manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces.

3.02 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with sealant manufacturer's recommendations.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

F. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.

G. Clean metal, glass, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Caulk all exterior joints and openings in the building envelope that are observable sources of air infiltration.

C. Measure joint dimensions and size materials to achieve required width/depth ratios.

D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width. Roll the material into the joint to avoid lengthwise stretching. Do not twist or braid rod stock.

E. Install bond breaker where joint backing is not used.

F. Prime surfaces to receive joint sealant with primer recommended by sealant manufacturer.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. Apply masking tape where required to protect adjacent surfaces from sealant application.

H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

I. Tool joints concave.

J. At all surface-mounted light fixtures mounted on gypsum board ceilings, contractor shall caulk light fixture body to ceiling finish to eliminate gap between metal body and fixture. Coordinate locations with drawings.

3.04 CLEANING AND REPAIRING

A. Clean work under provisions of Section 01 77 00.

B. Clean adjacent soiled surfaces. Use a solvent or cleaning agent as recommended by the sealant manufacturer.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01 66 00.

B. Protect sealants until cured.

C. Do not paint sealants until sealant is fully cured.

D. Do not paint silicone sealant.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Non-rated and fire rated rolled steel doors, panels, and frames.

B. Referenced Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 14 00 - Wood Doors and Frames.
3. Section 08 71 00 - Door Hardware.
4. Section 08 80 00 - Glazing.

1.02 REFERENCES

A. ANSI A250 .8 – Recommended Specification for Standard Steel Doors and Frames.

B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.

C. ANSI A250 .10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

D. ASTM A653-25 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot- Dip Process.

E. ASTM A924-22a - General Requirements for Steel Sheet, Zinc-Coated (Galvanized} by the Hot-Dip Process.

F. CEC - California Energy Commission.

G. NFPA 80 - Fire Doors and Windows.

H. SDl-105 - Recommended Erection Instructions for Steel Frames.

I. DHI - Door and Hardware Institute.

J. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.

K. UL 9 - Fire Tests of Window Assemblies.

L. UL 10C - Fire Tests of Door Assemblies.

1.03 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire rated door, panel and frame construction to conform to UL 9 and UL 1OC.

C. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated on Drawings.

D. Installed exterior frame and door assembly to be weather tight

E. Manufacturer shall have both fabrication and assembly plant located within the continental United States or Canada. Products that are either fabricated or assembled outside the continental United States or Canada are not acceptable.

1.04 SYSTEM REQUIREMENTS

A. Performance Requirements

1. Thermal Performance: Glazed exterior borrowed lite, side lite and transom lite frames shall have an overall minimum u-value of 1.19 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A.
2. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, side lite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.68 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-B.

A. Regulatory Requirements

1. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 for fire rated frames and doors.
2. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for u- value and solar heat gain coefficient.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.

B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.

C. Indicate door elevations, internal reinforcement, closure method, and cut outs for glazing and louvers.

D. Submit two (2) samples of exterior frame profile at mullion intersection.

E. Submit Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A and 116-8.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products under provisions of Section 016200.

B. Store products on site under cover.

C. Place products on at least 4-inch wood sills to prevent rust and damage.

D. Protect doors and frames with resilient packaging.

1.08 SEQUENCING AND SCHEDULING

A. Sequence work under the provisions of Section 01 32 13.

B. Schedule work under the provisions of Section 01 32 13.

C. Schedule delivery of all doors and frames so as not to delay progress of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Amweld Building Products, Inc., www.amweld.com.

B. Curries Mfg. Inc., www.curries .com.

C. Door Components, Inc., www.door components .com.

D. Fleming, www.flemingdoor.com.

E. Krieger Steel Products Company, www.kriegersteel.com.

F. Republic Builders Products Corporation, www.republicdoor .com.

G. Curries, www.curr ies.com.

H. Ceco, www.cecodoor .com.

I. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

A. Doors, Panels and Frames

1. Steel: Commercial quality cold rolled steel conforming to ASTM A653-25 galvanized to A60 or G60 coating class or Type 8, A40 (ZF120) according to ASTM A924 with minimized spangle, mill phosphatized.
2. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, minimum 0.053-inch-thick faces (16 GA. Minimum).
3. Exterior Frames: ANSI A250 .8, Level 3, 0.067-inch-thick material (14 GA. Minimum), core thickness.
4. Interior Frames: ANSI A250 .8, Level 2, 0.053-inch-thick material (16 GA. Minimum), core thickness.
5. Panels: Same materials and construction as specified for doors.

B. Door Core

1. Exterior Core: Polystyrene insulation.

C. Closer Channels

1. Close top and bottom edge of exterior door flush with inverted steel channel closure. Weld all joints watertight.

D. Frame Anchors

1. Masonry Anchors: Adjustable T-strap, 0.053-inch-thick steel, corrugated, 2-inch x 10-inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.
2. Metal Stud Anchor: Z type anchor, welded to frame, 0.053-inch-thick steel, UL listed as required for fire rating.
3. Floor Clip: Angle anchor, full width of frame, 0.067-inch-thick steel.

E. Protective Coatings

1. Bituminous Coating: Fibered asphalt-based corrosion proofing and sound deadener compound. Equivalent to Transcoat 101-F, www.oilservice.com.
2. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.

F. Hardware Reinforcement

1. Fabricate frames and doors with hardware reinforcement plates welded in place.

2. Hinge reinforcing shall be full width of frame profile.
3. Provide spacers for all thru-bolted hardware.
4. Reinforcement components shall be the following minimum thickness:
5. Hinge (door and frame) 3/16 inch
6. Mortise Lock or Deadbolt 0.093 inch
7. Bored Lock or Deadbolt 0.093 inch
8. Flush Bolt Front 0.093 inch
9. Surface Bolt 0.093 inch
10. Surface Applied Closer 0.093 inch
11. Hold Open Arm 0.093 inch
12. Pull Plates and Bars 0.067 inch
13. Surface Exit Device 0.093 inch
14. Floor Checking Hinge 0.167 inch
15. Pivot Hinge 0.167 inch

2.03 ACCESSORIES

A. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.

B. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.

2.03 FABRICATION

A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing·

B. All spliced joints shall occur on the interior side of exterior frames.

C. Fabricate frames as full profile welded units.

D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.

E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.

F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.

G. Provide 3/8-inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.

H. Mullions for Double Doors: Removable type supplied by Section 08 71 00.

I. Dust cover boxes or mortar guards of 0.016-inch-thick steel shall be provided at all hardware mortises on frames.

J. Reinforce frames wider than 48 inches with roll formed, 0.093-inch-thick steel channels fitted tightly and welded into frame head, inverted U-shape profile.

K. Prepare frame for silencers except for frames which receive weatherstripping. Provide three (3) single rubber silencers for single doors on strike side, and two (2) single silencers on frame head at double doors without mullions.

L. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader is not to be used for installation purposes.

M. Attach fire rated label to each frame and door unit.

O. Manufacturing Tolerances

1. Manufacturing tolerance shall be maintained within the following limits:
2. Frame width +1/16 inch -1/32 inch
3. Frame height +-3/64 inch
4. Frame face +-1/32 inch
5. Frame stop +-1/32 inch
6. Frame rabbet +-1/64 inch
7. Frame depth +-1/32 inch
8. Frame throat +-1/16 inch
9. Door width and height +-3/64 inch
10. Door thickness +-1/16 inch
11. Hardware location +-1/32 inch
12. Door flatness +-1/16 inch

2.4 FINISHES

A. Primer: Baked on rust-inhibitive enamel.

B. Finish: Site paint under provisions of Section 09 91 00.

C. Coat inside of frame profile for frames installed in masonry construction with bituminous coating to a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire rated frames.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install frames in accordance with SDI-105.

B. Install doors in accordance with DHI.

C. Install fire doors and frames in accordance with NFPA 80.

D. Installation of exterior doors and frames to be weathertight and waterproof.

E. Seal penetration of all surface applied screws on exterior face of frames at glass stops and hardware attachments.

F. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:

G. Frames up to 7 feet 6 inches height - 4 anchors each jamb.

H. Frames 7 feet 6 inches to 8 feet 0-inch height - 5 anchors each jamb, plus an additional anchor for each 2 feet or fraction thereof over 8 feet 0 inch.

I. Frames for double doors; minimum of two (2) anchors in head approximately 12 inches from each jamb.

J. Borrowed lite frames; two (2) anchors each jamb plus 1 for each 18 inches or fraction thereof over 3 feet 0 inch. Minimum two (2) anchors in head and sill approximately 12 inches from each jamb plus 1 for each 30 inches of length or fraction thereof.

K. Floor anchors - one (1) anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one (1) additional jamb anchor as close to floor as possible.

L. Existing wall anchors shall be welded to provide non-removable condition. Welded bolt head to be ground, dressed and finished smooth.

M. Frames installed in masonry walls to be fully grouted with masonry grout.

N. Exposed field welds to be finished smooth and touched up.

O. Primed or painted surfaces which are scratched or marred shall be touched up.

P. Hardware to be applied in accordance with hardware manufacturer's templates and instructions.

Q. Coordinate installation of glass and glazing.

S. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.02 CONSTRUCTION

A. INSTALLATION TOLERANCES

1. Edge clearance for swinging doors shall not exceed the following:
   a. Between door and frame at head and jamb: 1/8 inch.
   b. Between edge of pair of doors: 1/8 inch.
   c. At door sill with threshold. (From bottom of door to top of threshold): 3/8 inch.

d. At door sill with no threshold: 1/2 inch.
e. At door bottom and rigid floor covering per NFPA 80: 1/2 inch.
f. At door bottom and nominal floor covering per NFPA 80: 5/8 inch.

2. Frame installation tolerance shall not exceed the following:
   a. Squareness +-1/16 inch.
   b. Alignment +-1/16 inch.
   c. Plumbness +-1/16 inch.
   d. Diagonal Distortion +-1/32 inch.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

B. Section Includes: Description of requirements for materials, fabrication, and installation of wood doors, pre-fit and pre-machined for finish hardware. Solid-core flush wood doors with wood-veneer and paint-grade faces.

C. Related Work:

1. Section 08 11 00 – Metal Frames
2. Section 08 71 00 – Door Hardware
4. Section 09 91 00 – Painting
5. Section 10 14 00 – Signage

1.02 QUALITY ASSURANCE

A. References and Standards (latest Edition unless noted otherwise):

1. California State Fire Marshall Standard 12-43.4 for fire rated doors.
2. Commercial Standards – Solid wood construction, premium grade, solid block core – five ply, Type A with Type I adhesive.
3. NFPA 80 – Fire Doors and Windows
4. National Woodwork Manufacturers Association (NWMA):
   a. "Industry Standard for Hardwood Veneered.
   b. "Machining Flush Doors for Hardware".

5. AWS – Quality Standards of the Architectural Woodwork Institute (AWI)
6. Underwriters' Laboratories – UL 10B (neutral pressure) and UL 10C (positive pressure) – Fire Tests of Door Assemblies
7. ASTM E90-90 – Measurement of Airborne Sound Transmission Loss of Building Partitions
8. All cutouts sealed – factory of field.

B. All doors shall, as much as is practicable, be the products of one manufacturer.

1.03 SUBMITTALS (Submit under the provisions of Section 01 33 00)

A. Manufacturer's literature describing products.

B. Shop Drawings: Drawings shall show actual finished door dimensions, dimensions of existing frames, and clearances, floor covering conditions, construction, and location of all finish hardware. Doors shall be identified with the corresponding opening number shown on Door Schedule of the Drawings.

C. Certificates: Manufacturer's certification that materials and construction comply will applicable requirements of herein listed references and standards, and as specified herein.

D. Finishes: All doors to be unfinished for paint finishing on site.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience. All doors must be supplied through one Company.

B. Quality Standard: Doors to comply with WDMA IS 1A (Window and Door Manufacturers Association), AWS Section 9 (Architectural Woodwork Institute), or AWI with quality certification program (QCP).

C. Label Certification: All doors requiring fire-rating will carry either UL label. Manufacturer's certification labels may be used for door size variations if approved by AHJ (Authority Having Jurisdiction).

E. Delivery/Storage/Handling: Store and protect doors in accordance with manufacturer’s recommendations and WDMA or AWI Standards. Following are general guidelines.

1. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect/cover doors from dirt, water, and abuse.
2. Certain wood species are light sensitive. Protect doors from exposure to light (artificial or natural) after delivery.
3. Do not subject interior doors to extremes in either heat or humidity. HVAC systems must be operational and balanced, providing a temperature range of 50 to 80 degrees Fahrenheit and 25% to 55% relative humidity.
4. When handling doors, always lift and carry. Do not drag across other doors or surfaces. Handle with clean hands or gloves.
5. Each door will be marked on top rail with opening number.

1.05 WARRANTY

A. Manufacturer's signed warranty covering manufacturing or material defects for life of original installation, including repair or replacement.

PART 2 – PRODUCTS

2.01 DOORS

A. Doors shall conform with the drawings and door schedule and shall be of size, thickness, and type as required to fit frames. Doors shall be manufactured in accordance with applicable requirements of WIC Section 9, Wood-Veneer Face with Staved Lumber Core.

B. Pre-fit doors to frames and pre-machine for hardware.

C. Wood doors shall be equal to WIC, solid core, Type A, 5-ply construction, minimum. Door thickness to be 1-3/4” standard.

D. Reinforce doors for hardware scheduled under Section 08 71 00.

2.02 PREPARATIONS

A. Doors are to be prepared, and fitted specifically for the opening that they are to go in. Coordinate preparation for finish hardware to provide proper finished installation and permit operation without binding of any portion of the door and hardware.

B. Bevel vertical edges of doors 1/8" in 2".

C. Hardware Preparation:

1. Hardware Mounting Heights and Door Clearances: Refer to Section 08 71 00 for door clearances and hardware mounting heights.
2. Templates: Cutouts for mortise hardware shall be made at the factory form hardware manufacturer's templates and approved shop drawings.
3. Locate hinge mortise from top of door to top of hinge, 1/32" clearance in height and width, with depth sufficient to provide a flush surface when installed.
4. Locate lock mortise from top of door to center line of lever.
5. Mortise for Face Plates: 1/64" or larger in width and height, with depth to provide a flush surface when installed.
6. Lock Clearances:
   a. Bored Lock: 1/16" clearance for bore diameter for latch bolt and 1/8" clearance for bore diameter for lock case.

D. Undercut doors 1/2” typical or as indicated on the drawings.

2.03 SOURCE QUALITY CONTROL AND PRODUCT

A. Wood doors shall bear NWMA quality certified stamp.

1. Paint grade doors.

PART 3 – EXECUTION

3.01 INSPECTION

A. Assure that frame openings correspond to the dimensions furnished. Check that surfaces to contact frames are free of debris. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Doors shall be installed in accordance with the applicable requirements of WIC, Section I, and in accordance with manufacturer's recommendations. Doors shall be accurately hung in their respective frames, shall fit snug against stops and shall hang free from hinge bind.

B. Reseal edges of doors before installation, fitting or machining is required at the job site. If undercutting is required, work shall comply with manufacturer’s instructions. Maintain rated assembly where occurs.

3.03 ADJUST AND CLEAN

A. Cleaning/Finishing: Upon completion, clean all exposed surfaces, removing any discoloration or foreign matter. Touch up or repair abraded or cut areas and exposed edges with finishing material recommended by the manufacturer. Touch-up and repair shall not be obvious.

B. Final Adjustments: Check and readjust operating finish hardware just prior to final inspection. Leave work in complete and proper operating condition.

C. Defective Work: Remove and replace defective work, including doors which surfaces cannot be satisfactorily "touched-up", are hinge bound, warped, bowed or otherwise damaged, as directed by Architect, with no additional cost to the Owner.

D. Protect installed work against damage from other construction.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:

1. Door Hardware.
2. Thresholds, gasketing and weather-stripping.
3. Door silencers or mutes.

C. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 11 00 – Metal Doors and Frames.
3. Section 08 14 00 – Wood Doors

D. Related Documents

1. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 REFERENCES

A. 2025 California Building Code, CCR, Title 24.

B. BHMA – Builders' Hardware Manufacturers Association

C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. DHI – Door and Hardware Institute

E. NFPA - National Fire Protection Association.

1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
2. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives

F. UL - Underwriters Laboratories.

1. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies
2. UL 305 – Standard for Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.03 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit six (6) copies of schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Include a Cover Sheet with;
   a. Job Name, location, telephone number.
   b. Architects name, location and telephone number.
   c. Contractor’s name, location, telephone number and job number.
   d. Suppliers name, location, telephone number and job number.
   e. Hardware consultant's name, location and telephone number.

2. Job Index information included;
   a. Numerical door number index including; door number, hardware heading number and page number.
   b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
   c. Manufacturers' names and abbreviations for all materials.
   d. Explanation of abbreviations, symbols, and codes used in the schedule.
   e. Mounting locations for hardware.
   f. Clarification statements or questions.
   g. Catalog cuts and manufacturer’s technical data and instructions.

3. Vertical schedule format sample:
   a. Single or pair with opening number and location.
   b. Degree of opening
   c. Hand of door(s)
   d. Door and frame dimensions and door thickness.
   e. Label requirements if any.
   f. Door by frame material.
   g. (Optional) Hardware item line #.
   h. Keyset Symbol.

i. Quantity.
j. Product description.
k. Product Number.
l. Fastenings and other pertinent information.
m. Hardware finish codes per ANSI A156.18.
n. Manufacture abbreviation.

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

1.04 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing. To maintain the integrity of patented key systems, provide a letter of authorization from the specified manufacturer indicating that supplier has authorization to purchase the key system directly from the manufacturer.
3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

E. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

F. Pre-Installation Conference

1. Schedule a pre-installation conference at least one week prior to beginning work of this section.
2. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key Owner Personnel, and Project Inspector.
3. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review Owner's keying standards.

1.05 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.06 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:

1. Locksets: "L" Series (3) years – "ND" Ten (10) years.
2. Closers: Thirty (30) years –1260 twenty (20) years –Concealed High Security fifteen (15) years except electronic closers shall be two (2) years.
3. Exit devices: Three (3) years.
4. All other hardware: Two (2) years.

1.07 MAINTENANCE

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

2.01 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes

Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

A. Hinges: Ives as scheduled.

1. Ives 5BB1HW (Interior doors) 630 finish.

2. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 42" wide: 4-1/2" inches.
      2) Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.

3. Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges: Ives as scheduled.

1. Non-access control - SL-224HD (Exterior doors) 628 finish.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.

1. Non-access control - Classroom Safe School Lock ND98
2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
   a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
   b. Offset lever pull – minimum 1,600-foot pounds without gaining access
   c. Vertical lever impact – minimum 100 impacts without gaining access
3. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
4. Cylinders: Refer to “KEYING” article, herein.
5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

D. Exit devices: Von Duprin as scheduled.

1. Non-access control - CD98L-AX-996L-KC-PA x CD98DT x KR4954 Mullion x 154 (Pairs) 626 finish
   a. No vertical rods allowed.
   b. Use -2 Function to meet AB 211.
   c. MT54 Mullion Storage at Pairs.
   d. Provide 154 stabilizers at all mullions.
5. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
6. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latch bolts shall be deadlocking with ¾” throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: “Breakaway” design, forged brass or bronze escutcheon with a minimum of .130” thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
    a. MT54 Mullion Storage at Pairs
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.

14. Panic Hardware shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
    b. Provide exit devices UL certified to meet maximum 5-pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.

Commented [JR1]: Same same

Commented [JR2]: Same same

E. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

1. P4041XP 689 finish
    a. Hold open arms or cush closers are not allowed.
2. Door closer cylinders shall be of high strength cast iron construction with double heat-treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
3. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
4. All parallel arm closers shall incorporate one-piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
5. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
6. Closers shall be installed to permit doors to swing 180 degrees.
7. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
8. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed. Door frames shall be reinforced at all mounting locations.
9. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. 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. Per 11B- 404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

F. Flush Bolts & Dust Proof Strikes: Ives as scheduled.

1. FB51 (Manual) (metal doors) (Storage & Utility rooms) 626 finish
    b. Provide dust proof strikes at openings using bottom bolts.
    c. Automatic flush bolts allowed only where required by Fire Code.

G. Door Stops: Ives as scheduled.

1. FS18S (Exterior Floor) 626 finish
2. FS 436/438 (Interior Floor) 626 finish
3. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).

H. Door Holders: Ives as scheduled.

1. WS452-4 Series Automatic Holder (Door) 626 finish
2. FS40 Series Automatic Holder (Wall) 626 finish
   a. Backing required at wall holders
   b. Allow for maximum door swing

I. Protection Plates: Ives as scheduled.

1. Kick Plate: 8400-10" x 2" LDW 630 finish
2. Fabricate either kickplates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
3. Lock Protector: LG-13, LG-12 626 finish

J. Thresholds: As Scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
3. Use ¼" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 11B-404.2.5.

K. Seals and Surface Applied Hardware: Zero as scheduled.

1. Weather Seal: 488S-BK 628 finish

-and-

   8780N Factory
2. Door Sweep: 328AA 689 finish
3. Drip Guard: 17D x 4" PDW (Exterior doors exposed to rain) 628
4. Provide silicone gasket at all rated and exterior doors.

L. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

M. Silencers: Ives as scheduled.

1. 654A, 655A, 623A Black

2. Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

N. Keying: Schlage as scheduled.

1. Furnish a Proprietary Schlage master key system as directed by the owner or architect. Key system to be designated and combination-d by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer. This is to be a Schlage PrimusXP "Classic" keying system. SCUSD to verify all keyways. Provide as follows:
   a. 6 pin x Standard Core plug (ND Series) 626 finish
   b. 6 pin x Rim type x IC Core (Exit Device) 626 finish
   c. 6 pin x 1-1/4" Mortise x IC Core (KR Mullions and CD) 626 finish

2. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
3. Establish a new master key system for this project as directed by the keying schedule.
4. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
5. Furnish PrimusXP "Classic" keyway Patent Protected Schlage cylinders where noted. Furnish all other cylinders in matching conventional "Classic" keyway. Furnish Patent Protected Schlage keys for all cylinders. (e.g., Primus XP Classic Keyway for patent protected / Maximum control) (with mix of conventional "Classic" keyway)
6. Furnish construction keying for doors requiring locking during construction.
   a. For FSIC systems provide 23-030-ICX Full Size Construction Cores
   b. For FSIC systems provide ten 48-101-ICX Construction Keys
   c. For FSIC systems provide two 48-056-ICX Control Keys (const.)
   d. For FSIC systems provide two control keys for installing the permanent cores (49- 056 for "Classic" keyways, 48-052-XP for "Classic Primus").

-OR-

7. Furnish construction keying for doors requiring locking during construction.
   a. For "Split Key" Construction Cylinders (non-IC cylinders) specify "CK" for each keyed cylinder.
   b. Provide ten Construction Keys (48-104 "Classic")
   c. Provide two Extractor Tools (35-057)

8. Furnish all keys with visual key control.
   a. Stamp key "Do Not Duplicate".

9. Furnish mechanical keys as follows:
   a. Furnish 2 cut change keys for each different change key code.
   b. Furnish 1 uncut key blank for each change key code.
   c. Furnish 6 cut master keys for each different master key set.
   d. Furnish 3 uncut key blanks for each master key set.

e. Furnish 2 cut control keys cut to the top master key for permanent I/C cylinders.
f. Furnish 1 cut control key cut to each SKD combination.
g. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47- 413 (conventional) or 47-743-XP (PrimusXP) with above.
h. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic) or 20-740 (PrimusXP) with above.
i. Furnish KS41D1200 padlock for use with FSIC Schlage cylinders.

O. Fasteners

1. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
2. Screws for butt hinges shall be flathead, countersunk, full-thread type.
3. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
4. Provide expansion anchors for attaching hardware items to concrete or masonry.
5. All exposed fasteners shall have a Phillips head.
6. Finish of exposed screws to match surface finish of hardware or other adjacent work.
7. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

2.04 FINISHES

A. Generally, to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.

I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.

J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.

K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.

L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer’s technical documentation.

J. Hardware Locations

1. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.03 ADJUSTING AND CLEANING

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.05 FIELD QUALITY CONTROL

A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.

C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers
PEM	=	Pemko	Threshold, Door bottoms, Door cap
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HARDWARE GROUP NO. 001 – INTERIOR CLASSROOM DOOR

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	BUTT HINGE PRS, 4.5" x 4.5"	5BB1HW	630	IVE
1	EA	LEVER LOCKSET	ND98-RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	AS REQUIRED	626	SCH
1	EA	CLOSER, PARRALLEL ARM	4041XP	689	LCN
2	EA	MOP PLATE 5"x 34"	8400	630	IVE
1	EA	FLOOR STOP	FS436	BLK	IVE

HARDWARE GROUP NO. 002 – EXTERIOR CLASSROOM DOOR
UNEVEN PAIR WITH 36" OPERABLE LEAF AND 24" IN-OPERABLE LEAF

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. GEARED HINGE	22HD	628	IVE
1	EA	LEVER LOCKSET *OPERABLE LEAF ONLY*	ND98-RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	AS REQUIRED	626	SCH
1	EA	CLOSER *OPERABLE LEAF ONLY*	4041XP	689	LCN
1	EA	FLUSH BOLTS *IN-OPERABLE LEAF ONLY*	FS51P	630	IVE
1	EA	LOCK GUARD	LG13	630	IVE
1	EA	KICK PLATE 10"x 34" *OPERABLE LEAF*	8400	630	IVE
1	EA	KICK PLATE 10"x 22" *IN-OPERABLE LEAF*	8400	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
2	EA	DOOR SWEEP	328	AA	ZER
2	EA	DOOR SHOE	2221_V	A	PEM
2	EA	DOOR CAP	344	PA	PEM
1	EA	DOOR DRIP *ONE CONT. DRIP OVER PAIR*	142	ALUM	ZER
1	EA	GASKETING ENTIRE FRAME	488S	BK	ZER
1	EA	WEATHERSTRIPPING *AT FRAME AND LATCH SIDE OF DOORS*	8780N	BLACK	ZER
1	EA	THRESHOLD *FULL WIDTH OF PAIR*	2548	AL	PEM
2	EA	THRU-DOOR VIEWER *OPERABLE LEAF ONLY*	698	626	IVE

END OF SECTION

5BB1HW



5 Knuckle, ball bearing, heavy weight full mortise hinge

- Recommended for heavier weight doors (>150 lbs)
- Recommended for high frequency usage (400 cycles per day)
- Made with four ball bearing assemblies
- Recommended for use with a door closer
- Packed with fasteners for hollow metal and wood doors
  – 12-24 x 1/2 UFPHMS, 12 x 1 1/4 FPHWS

Specifications

Material substrate	Made from brass, 1040 steel or 304 series stainless steel
Certifications	▪ Certified ANSI/BHMA A156.1 for performance standards ▪ Meets ANSI/BHMA 156.7 for template hinge dimensions ▪ UL Classified for windstorm rated assemblies - R37965 ▪ UL 10C Listed for steel only (3 hour)

Dimensions

Height x Width	Size (mm)	Gauge
4.5 x 4	114 x 102	0.180
4.5 x 4.5	114 x 114	0.180
5 x 4.5	127 x 114	0.190
5 x 5	127 x 127	0.190

Refer to General Hinge Information page to determine proper hinge for application

Options

NRP	Non-removable pin	**TW4**	Four wire
HT	Hospital tip	**TW4M**	Four wire with monitor
SH	Security stud - comes standard with NRP	**TW8**	Eight wire
RC-1/4, RC-5/8	Rounded corners	**TW8M**	Eight wire with monitor
SEC	Security fasteners - pin-in-socket	**TW12**	Twelve wire
	(for hollow metal doors and frames only)	**MON**	Monitor

Finishes

BHMA	Description	Substrate	Finish
600	Primer Paint	Steel	USP
605	Bright Brass	Brass	US3
606	Satin Brass	Brass	US4
612	Satin Bronze	Brass	US10
613	Oil Rubbed Bronze	Brass	US10B
614	Oxidized Bronze	Brass	US10A
619	Satin Nickel	Brass	US15
622	Matte Black	Brass	B-BLK
625	Bright Chrome	Brass	US26
626	Satin Chrome	Brass	US26D
643e/716	Aged Bronze	Brass	B-643e/716
629	Bright Stainless	Stainless steel	US32
630	Satin Stainless	Stainless steel	US32D
631	Matte Black	Steel	F-BLK
632	Bright Brass	Steel	US3
633	Satin Brass	Steel	US4
639	Satin Bronze	Steel	US10
640	Oil Rubbed Bronze	Steel	US10B
641	Oxidized Bronze	Steel	US10A
646	Satin Nickel	Steel	US15
651	Bright Chrome	Steel	US26
652	Satin Chrome	Steel	US26D
643e/716	Aged Bronze	Steel	F-643e/716
695	Dark Bronze Painted	Steel	F-695/US10BE

For other colors, consult factory.

224HD

Full mortise - door edge protector

- For 1 3/4" doors
- Door edge protector
- Spread bearing design
- Non-handed for custom cut lengths
- 1/16" Door Inset
- 48" Maximum door width
- Beveled or square edge doors
- For doors weighing up to 450 pounds without reinforcing, 600 pounds with reinforcing



224HD – spread bearing design



Specifications

Standard length	83", 85", 95", 120"
Standard mounting hardware	12-24 x 3/4" Steel self drilling/self tapping Phillips-head screw
Certifications	▪ Exceeds Grade 1 ANSI/BHMA 156.26 for 150lbs ▪ UL10C listed (90 min)

Options

EPT	Electric power transfer

Optional mounting hardware

SECHM	Security screws - hollow metal door and frame
SECWDHM	Security screws - 1/2 wood, 1/2 hollow metal
SECWDWD	Security screws - wood door and frame
TEKSWD	1/2 Self drill, self tap 1/2 wood
TF	Thread forming screws
WD	Wood door and frame

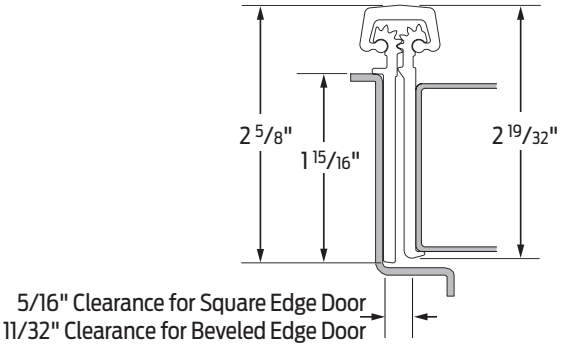
Finishes

BHMA	Description	Substrate	Finish
628	Clear Aluminum Anodized	Aluminum	US28
710	Dark Bronze Anodized	Aluminum	313AN
711	Black Anodized	Aluminum	315AN

Custom anodizing and painting are available, consult factory

For single door applications:

For pairs of doors see chart and general information.



ND MECHANICAL



Applications

The ND Series' functional and trim offerings are the most expansive of the Schlage cylindrical lock portfolio. This extremely versatile lock is made to handle the abuses of heavy use in any commercial setting. Options include best-in-class lock status indication ideal for classroom security and ligature-resistant options for the healthcare market.

Because ND uses an ANSI door prep common across cylindrical locks, it is ideal for both new construction and retrofit upgrades.

Key Features

- Significantly exceeds ANSI/ BHMA A156.2 requirements for Grade 1 cylindrical locks
- 27 mechanical functions plus eight that feature Vandlgard® locked lever protection
- Nine lever designs, two rose designs, status indication and ligature-resistant trim options
- Nine standard finishes, plus an antimicrobial coating option
- Supports Conventional, FSIC, SL and SFIC cylinder formats plus high-security UL 437 options
- Multiple key systems available – open, patented, restricted, and geographically exclusive
- Support for 10 non-Schlage cores (see cylinder section)

ND WIRED ELECTRIFIED



Applications

Electrified locks complement mechanical ND Series where wired electronic access control solutions are desired. They can be applied as part of a network or independently with a remote access switch such as may be used for a reception area.

Electrified ND locks are ideal for high-traffic areas where line power ensures continuous operation. They are most easily incorporated into new construction where electrified door prep, conduit hinges, and wiring is planned for the building.

Key Features

All mechanical features plus:

- Combines mechanical strength with the convenience of electronic access control
- Auto-detects 12V or 24V DC
- Selectable EL/EU operation
- Three electrified functions
- Low 0.24 amp max current draw allows multiple locks on a single power supply
- Low 0.01 amp holding current eliminates "hot levers" in electrically locked applications
- Modular Request-to-Exit (RX) can be added at any time

NDE WIRELESS ELECTRONIC



Applications

NDE mobile enabled wireless locks are designed to affordably extend electronic access control deeper into the building beyond traditional perimeter and high security openings.

The NDE is ideal for both commercial new construction and retrofit. Facilities can benefit from the enhanced security, efficiency, and convenience of upgrading to electronic credentials.

Key Features

All mechanical features[1] plus:

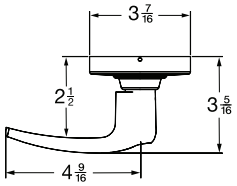
- Interior push button with indication for storeroom, office, privacy and apartment functionality
- Compatible with Bluetooth, NFC, smart, or proximity credentials
- Integrated credential reader, door position sensor, and request-to-exit (RX) switch
- Built-in Bluetooth® enables wireless configuration from smart phones/tablets
- Functions in offline or No-Tour mode or as a networked lock with either periodic check-ins or real-time management
- Up to 2 years of battery life

1. NDE wireless electronic is not available in 613 finish.

Lever Designs & Finishes

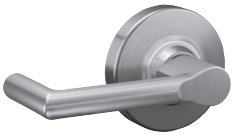
Athens (ATH)

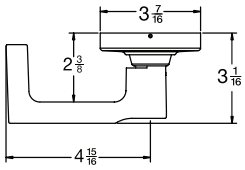




Cores *KIL, FSIC, SFIC, L-CO, L-SA, J-CO6, J-ME, J-SA, J-YA6*

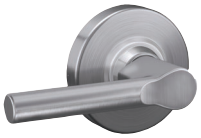
Boardwalk (BRK)[1]

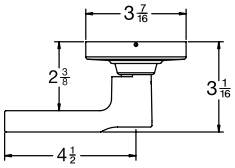




Cores *KIL, FSIC, SFIC*

Broadway (BRW)

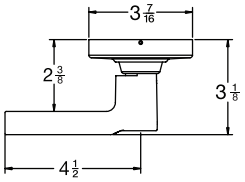




Cores *KIL, FSIC, SFIC*

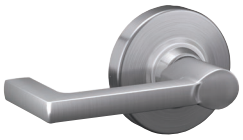
Latitude (LAT)

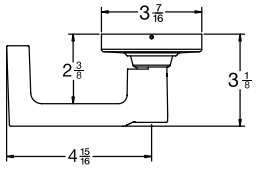




Cores *KIL, FSIC, SFIC*

Longitude (LON)[1]

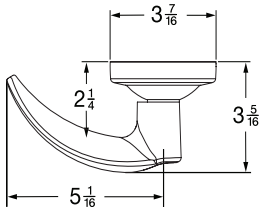




Cores *KIL, FSIC, SFIC*

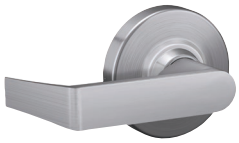
Omega (OME)[1]

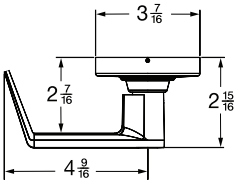




Cores *KIL, FSIC, SFIC*

Rhodes (RHO)[1]

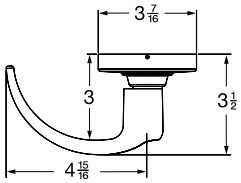




Cores *KIL, FSIC, SFIC, L-CO, L-SA, J-CO6, J-CO7, J-ME, J-SA, J-YA6, J-YA7*

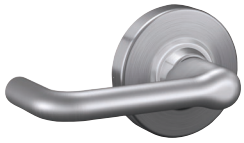
Sparta (SPA)[1]

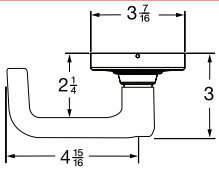




Cores *KIL, FSIC, SFIC, L-CO, L-SA, J-CO6, J-ME, J-SA, J-YA6*

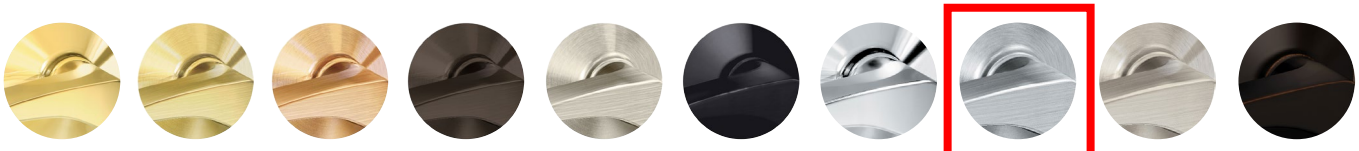
Tubular (TLR)[1]





Cores *KIL, FSIC, SFIC, L-CO, L-SA, J-CO6, J-ME, J-SA, J-YA6*

Finishes

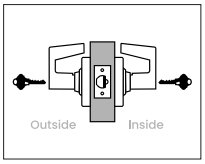


605 Bright Brass	606 Satin Brass	612 Satin Bronze	613[2] Oil Rubbed Bronze	619 Satin Nickel	622 Matte Black	625 Bright Chrome	626/626AM Satin Chrome/ Antimicrobial	630[3] Satin Stainless Steel	643e Aged Bronze

1. Boardwalk, Longitude, Omega, Rhodes, Sparta, and Tubular levers comply with California state code for return within 1/2" of door face.
2. NDE wireless electronic locks not available in 613 and 630 finishes.
3. Available on HSLR trim only.

Keyed, Double Cylinder Functions

Schlage **ANSI**
ND72 with XN12-002 **F80**



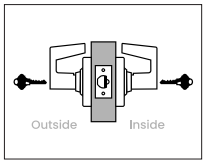
Communicating lock

- Lever with key cylinder both sides; deadlatch
- In unlocked state latch is retracted by either lever
- Key in either lever makes inoperative only that lever
- Key in either lever retracts the latch and unlocks only that lever

Caution: Double cylinder locks on any door, in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

To order, specify function and note XN12-002 as a special option.

Schlage **ANSI**
ND72 with XN12-003 **F80**



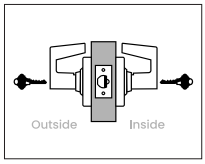
Vandlgard® communicating lock

- Lever with key cylinder both sides; deadlatch
- In unlocked state latch is retracted by either lever
- Key in either lever makes inoperative only that lever; Vandlgard® allows locked lever to rotate freely when locked
- Key in either lever retracts the latch and unlocks only that lever

Caution: Double cylinder locks on any door, in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

To order, specify function and note XN12-003 as a special option.

Schlage **ANSI**
ND78 **F110**



Classroom security lock (180-degree lockdown)

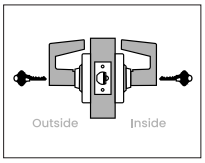


- Lever with key cylinder both sides; deadlatch
- In unlocked state latch is retracted by either lever
- Outside lever is made inoperative by rotating key in either lever 180 degrees counter-clockwise and returning to start position
- Unlock outside lever by rotating key 180 degrees clockwise in either lever and returning to start position
- Inside lever always free for immediate egress

Locks ordered in 626 finish come standard with instruction rose (47342586) identifying key rotation direction for rapid lockdown. Other finishes receive a standard rose.

Note: Locks ordered with indicator trim fit 1-3/4" doors. Sold separate spacer kits allow application to doors 1-3/8" to 1-11/16".

Schlage **ANSI**
ND82 **F87**



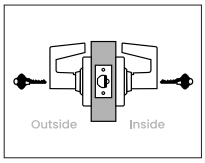
Institution lock



- Lever with key cylinder both sides; deadlatch
- Both levers are always fixed
- Key in either lever retracts latch only

Caution: Double cylinder locks on any door, in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

Schlage **ANSI**
ND93 **F88**



Vandlgard® vestibule lock

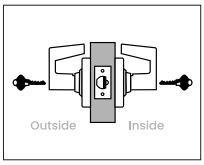


- Lever with key cylinder both sides; deadlatch
- In unlocked state latch is retracted by either lever
- Outside lever is made inoperative by key inside; key outside does not lock; Vandlgard® allows outside lever to rotate freely when locked
- Key outside retracts latch but cannot unlock outside lever; only key inside unlocks
- Inside lever always free for immediate egress

Note: Available with optional instruction rose identifying key rotation direction for rapid lockdown. 626 finish only.

To order with instruction rose specify function and note XN12-035 as a special option.

Schlage **ANSI**
ND98 **F110**



Vandlgard® classroom security lock (180-degree lockdown)



- Lever with key cylinder both sides; deadlatch
- In unlocked state latch is retracted by either lever
- Outside lever is made inoperative by rotating key in either lever 180 degrees counter-clockwise and returning to start position; Vandlgard® allows outside lever to rotate freely when locked
- Unlock outside lever by rotating key 180 degrees clockwise in either lever and returning to start position
- Inside lever always free for immediate egress

Locks ordered in 626 finish come standard with instruction rose (47342586) identifying key rotation direction for rapid lockdown. Other finishes receive a standard rose.

Note: Locks ordered with indicator trim fit 1-3/4" doors. Sold separate spacer kits allow application to doors 1-3/8" to 1-11/16".

FB51P / FB51T

Top bolt and bottom bolts - metal doors

- FB51P top and bottom bolts (pair)
- FB51T top bolt only
- For use with metal doors only
- Constant latching—inactive door remains latched until the active door is opened, releasing the automatic bottom bolt and then the top bolt can be manually released (inactive door will re-latch automatically when closed)
- Low actuation forces
- Non-handed
- Bolt throw is 3/4" with a 7/8" vertical adjustment
- Bolt backset is 3/4"
- Standard rod length is 12", which is measured from the center of the flush bolt body to the bolt tip



Specifications

Mounting hardware	▪ 8-32 X 3/8" UFPHMS ▪ 10-12 X 1 1/4" Plastic anchor ▪ 6-32 X 3/8" FPHMS ▪ 6 X 3/4" FPHSMS ▪ 8 X 1" FPHSMS ▪ 10 X 1" FPHSMS
Certifications	▪ Fits standard ANSI/BHMA A115.4 door frame preparations. ▪ UL10C Listed (3 hour) fire doors 8'0" X 10'0" when top and bottom bolts are used

Options

Optional rod lengths available for top bolt only on non-fire rated openings—18", 24", 36" and 48"

Dimensions

Body size (Width x Length x Depth)	Guide size (Width x Length x Height x Thickness)	Strike size (Width x Length x Thickness)	Rub plate size (Width x Length x Thickness)
1" x 6 3/4" x 2"	1" x 1 27/32" x 11/16" x 3/32"	15/16" x 2 1/4" x 1/16"	1 1/4" x 1 11/16" x 3/64"

Finishes

BHMA	Description	Substrate	Finish
605	Bright Brass	Brass	US3
606	Satin Brass	Brass	US4
612	Satin Bronze	Brass	US10
613	Oil Rubbed Bronze	Brass	US10B
BLK	Matte Black	Stainless steel	–
629	Bright Stainless Steel	Stainless steel	US32
630	Satin Stainless Steel	Stainless steel	US32D

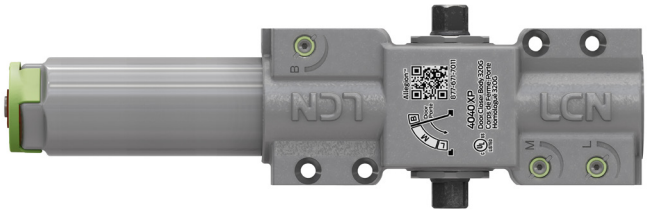
Custom finishes are available as engineering special, consult customer service.

Additional accessories

- Security pin screws
- DP1 and DP2 dust proof strike, see page 167

4040XP Series





The 4040XP Series is LCN's most popular door closer—and for good reason. This durable, non-handed, surface-mounted, heavy-duty closer is designed for the most demanding high-use-and-abuse applications as well as for easy installation and maintenance.

Features

Certifications	Grade 1 - ANSI A156.4, UL 10C, ADA, 100 hour salt spray, meets BAA - Buy American Act
Body construction	▪ Patented positive stop ▪ Patented regulation valve indicators ▪ Independent speed adjustments ▪ QR code for instructions and support ▪ Cast iron body ▪ Full complement bearing ▪ 1 ½" diameter piston ▪ Double heat treated pinion journal
Fluid	All-weather Liquid X hydraulic fluid
Handing	Non-handed
Templating	Peel-n-Stick templates - 2 ¼" x 5" mounting hole pattern
Size	Adjustable spring size 1-6, includes LCN Green Dial
Warranty	30 years

Cover	▪ Snap-fit plastic cover (PC) with retention fit, standard ▪ Metal cover (MC), optional
Fasteners	Self reaming and tapping screws (SRT)
Mounting	Hinge (pull side), top jamb (push side), parallel arm (push side)
Arms	Regular arm
Finishes/colors/ powder coat	▪ 622 Matte black ▪ 689 Aluminum ▪ 690 Statuary bronze ▪ 691 Light bronze ▪ 693 Black ▪ 695 Dark bronze ▪ 696 Brass ▪ Custom colors optional
	▪ Optional SRI primer - powder coat only ▪ Optional plated finishes

Product Configurations

Mounting						Finish			Cover			Cylinder			Arm function*						
Hinge (pull) side	Top jamb (pull)	Top jamb (push)	Parallel arm	Stop face		Powder coat	Plated		Plastic	Metal		Non-handed	Non-sized	Accessibility	Delay Action***	CYLAVB**		Regular (double)	Standard (single)	Hold Open	Fusible Link	EDA/HEDA	CUSH/HCUSH	SCUSH/SHCUSH	Double Egress
■	■	■	■	■		■	■		■	■		■	■	♿	■	■		120°	■	120°	■	180°	110°	110°	■

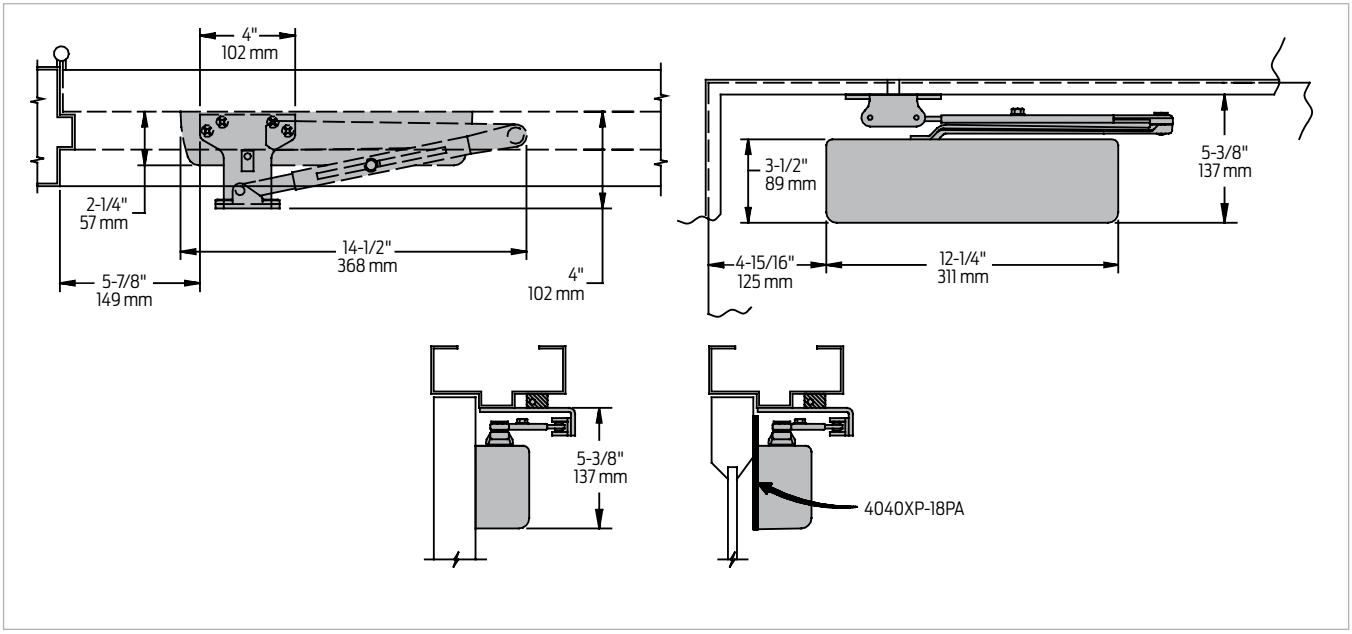
■ Available
■ Not available

♿ Closer available with less than 5.0 lbs. opening force on 36" door.
* Maximum opening/hold open point with standard template.
** Advanced Variable Back Check.
*** Delay feature incorporates standard 4040 cylinder (not XP).

Note: Special Templates - Customized installation templates or products may be available to solve non-standard applications. Contact LCN Product Support for assistance.

Mounting details

Parallel arm (push) side mounting



Butt hinges	Should not exceed 5" (127 mm) in width
Auxiliary stop	Recommended at hold open point, where the door cannot swing 180°, or where Cush-n-Stop Arm is not used
Reveal	Should not exceed 7/32" (6 mm)
Top rail	Less than 5 3/8" (137 mm) measured from the stop requires plate, 4040XP-18PA; plate requires 2" (51 mm) minimum from the stop
Head frame	Flush or rabetted requires PA shoe adapter, 4040XP-419
Stop width	Minimum 1" (25 mm); CUSH arm requires minimum 1 1/2" (38 mm)
Blade stop	Clearance requires 1/2" (13mm) blade stop spacer, 4040XP-61
Clearance	▪ 4040XP-62PA shoe is 4" (102 mm) from door face ▪ EDA shoe projects 5 1/2" (140 mm) from door face ▪ CUSH shoe projects 6" (152 mm) from door face
Delay action	▪ Incorporates standard 4041 cylinder, without XP cylinder ▪ Delays closing from 120° to 70° ▪ Delay time adjustable up to approximately 1 minute
Maximum opening	▪ 180° opening/hold open points with all except CUSH arms ▪ 110° opening/hold open with CUSH arms

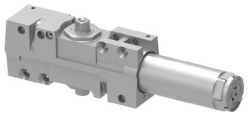
Notes:
- Optional mounting requires PA shoe, 4040XP-62PA for regular or Hold Open Arms
- Add prefix "P" to closer description (eg. P4040XP)
- P4040XP closer includes 4040XP-201 fifth hole spacer to support PA shoe

Accessories

Cylinders

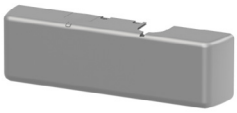


4040XP-3071
Cast iron cylinder assembly (CYL)
- Non-handed
- Heavy duty

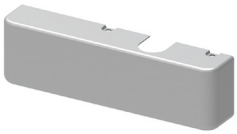


4041-3071 DEL
Delay Action Cylinder (CYLDEL)
- Used for delayed action closing
- Non-handed
- Heavy duty

Covers



4040XP-72
plastic cover (PC)
- Non-handed
- Includes 4040XP-54 snap-on cover clip
- Patented snap-fit cover with improved retention fit



4040XP-72MC
metal cover (MC)
- Handed
- Required for plated finishes and custom powder coat finishes
- Optional

Arms



4040XP-3077
Regular Arm (REGARM)
- Non-handed
- Mounts pull side or top jamb with shallow reveal P4041 closer includes PA shoe, 4040XP-62PA required for parallel arm mounting



4040XP-3077L
Long Arm (LONG)
- Non-handed
- Includes long rod and shoe, 4040XP-79LR for top jamb mount
- Optional



4040XP-3077ELR
Extra Long Arm (XLONG)
- Non-handed
- Includes extra long rod and shoe, 4040XP-79ELR for top jamb mount with deep reveal
- Optional



4040XP-3049
Hold Open Arm (H)
- Non-handed
- Mounts pull side or top jamb with shallow reveal, hold open adjustable shoe
- 4040XP-62PA shoe required for parallel arm mounting
- Optional



4040XP-3049L
Hold Open Long Arm (HLONG)
- Non-handed
- Includes long head and tube, 4040XP-3048L for top jamb mount
- Optional



4040XP-3077EDA
Extra Duty Arm (EDA)
- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- Optional



4040XP-3049EDA
Hold Open Extra Duty Arm (HEDA)
- Handed
- Parallel arm features forged, solid steel main and forearm for potentially abusive installations
- Hold open function is adjusted at the shoe
- Optional



4040XP-3077EDA/62G
Extra Duty Arm with 62G Thick Hub Shoe (EDAW62G)
- Non-handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance
- Optional



4040XP-3049EDA/62G
Hold Open Extra Duty arm with 62G Thick Hub Shoe (HEDA62G)
- Handed
- Features forged, solid steel main and forearm for potentially abusive installations
- 62G shoe provides additional blade stop clearance; hold open function is adjusted at the shoe
- Optional



4040XP-3077CNS
Cush-n-Stop Arm (CUSH)
- Non-handed
- Features solid forged steel main arm and forearm with stop in soffit shoe.
- Optional



4040XP-3049CNS
Hold Open Cush-n-Stop Arm (HCUSH)
- Non-handed
- Hold open function with templated stop/hold open points
- Handle controls hold open function
- Optional

Accessories

Arms (cont.)



4040XP-3077SCNS
Spring Cush-n-Stop Arm (SCUSH)
- Non-handed
- For potentially abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Optional



4040XP-3049SCNS
Spring Hold Open Cush-n-Stop Arm (SHCUSH)
- Non-handed
- For potentially abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe
- Handle controls hold open function
- Optional

Installation accessories



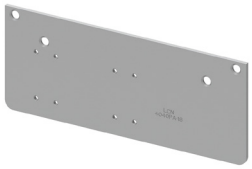
4040XP-18
Plate
- Required for hinge side mount where top rail is less than 3 3/4" (95 mm)
- Requires minimum 2" (51 mm) minimum top rail



4040XP-18G
Plate
- Locates top jamb mounted closer flush with top of head frame face in flush ceiling condition
- Requires 1 3/4" (44 mm) minimum head frame



4040XP-18TJ
Plate
- Centers top jamb mounted closer vertically on head frame where face is less than 3 1/2" (89 mm). Plate requires 1 3/4" (44 mm) minimum head frame



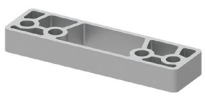
4040XP-18PA
Plate
- Required for parallel arm mounting where top rail is less than 5 1/2" (140 mm), measured from the stop
- Requires 2" (51 mm) minimum top rail



4040XP-62PA
PA shoe
- Required for parallel arm mounting



4040XP-30
CUSH shoe support
- Provides anchorage for fifth screw used with CUSH arms, where reveal is less than 3 1/16" (78 mm)
- Optional



4040XP-61
Blade stop spacer
- Required to lower parallel arm shoe to clear 1/2" (13 mm) blade stop
- Optional



4040XP-419
PA flush panel adapter
- Provides horizontal mounting surface for parallel arm shoe on single rabbeted or flush frame
- Optional



4040XP-62A
Auxiliary shoe
- Requires a top rail of 7" (178 mm)
- Shoe replaces -62PA for parallel arm mounting of regular arm with overhead holder/stop
- Optional

Ordering information

How-to-order 4040XP Series closers

1. Select finish

☐ Standard powder coat _____
Matte Black (622), Aluminum (689), Dark Bronze (695), Statuary Bronze (690), Light Bronze (691), Black (693), or Brass (696)

Closer will be shipped with:
- Standard cylinder
- Standard cover
- Regular arm
- Self reaming and tapping screws
(unless options listed below are selected)

Closer options

Cylinder
☐ Delay action cylinder (CYLDEL)

Cover
☐ Metal (specify right or left hand)(MC)

Finish
☐ Custom powder coat (RAL) _____
(handed metal cover required)
☐ Plated finish, US _____
(handed metal cover required)
☐ SRI primer
(use with powder coat finishes only)

Arm
☐ Regular Arm (REGARM)
☐ Regular Arm with Parallel Arm Bracket (RWPA)
☐ Regular Arm with 62A Auxiliary Shoe (RW62A)
☐ Long Arm (LONG)
☐ Extra Long Arm (XLONG)
☐ Hold Open Arm (H)
☐ Hold Open with Parallel Arm Bracket (HWPA)
☐ Hold Open Long Arm (HLONG)
☐ Extra Duty Arm (EDA)
☐ Extra Duty Arm with 62G Thick Hub Shoe (EDAW62G)
☐ Hold Open Extra Duty Arm (HEDA)
☐ Cush-n-Stop Arm (CUSH)
☐ Hold Open Cush-n-Stop Arm (HCUSH)
☐ Spring Cush-n-Stop Arm (SCUSH)
☐ Spring Hold Open Cush-n-Stop Arm (SHCUSH)

Optional screw packs
☐ Through bolt[1] self reaming and tapping screws (TBSRT)
☐ Wood and machine screws (WMS)
☐ Through bolt[1] wood and machine screws (TBWMS)
☐ Torx machine screws (TORX)
☐ Through bolt[1] and torx machine screws (TBTRX)

Installation accessories
☐ Plate, 4040XP-18
☐ Plate, 4040XP-18TJ
☐ Plate, 4040XP-18G
☐ Plate, 4030-18PA
☐ CUSH shoe support, 4040XP-30
☐ Blade stop spacer, 4040XP-61
☐ Auxiliary shoe, 4040XP-62A
☐ PA flush panel adapter, 4040XP-419

Special template
☐ ST- _____

1. Specify door thickness if other than 1 3/4".

Table of sizes

- 4040XP cylinders are adjustable from size 1 through size 6 and is shipped set to size 3
- Closing power of 4040XP Series closers may be adjusted 50%

Exterior (and vestibule) door width

24" 610mm	30" 762mm	36" 914mm	42" 1067mm	48" 1219mm
*4040XP	size 3	size 4	size 5	size 6

Minimum door width

Interior door width

24" 610mm	30" 762mm	38" 965mm	48" 1219mm	54" 1372mm	60" 1524mm
*4040XP	size 2	size 3	size 4	size 5	size 6

Minimum door width

→ Indicates recommended range of door width for closer size.
* Adjustable Size 1 thru 5.

Reduced opening force 4040XP Series closers

CAUTION! Any manual door closer, including those certified by BHMA to conform to ANSI Standard A156.4, that is selected, installed and adjusted based on ADA or other reduced opening force requirements may not provide sufficient power to reliably close and latch a door.

Refer to Automatic Operators catalog for information on systems that meet reduced opening force requirements without effecting closing power.

Door width	36"	42"	48"
8.5* lbs.	4040XP	4040XP	4040XP
5.0* lbs.	4040XP	4040XP	4040XP

* Maximum opening force.

LG13



Lock guard

- Designed for use on all type 161 cylindrical locks (ANSI/BHMA 156.2 Series 2000) Monolock and Unilock
- Unique design provides maximum security, virtually eliminating the opening between door and frame at latch point
- Non-handed
- 2 welded mounting studs (no exposed fasteners on face of unit)

Specifications

Material substrate	Made from 13 gauge stainless steel, 12 gauge steel
Certifications	UL10C Listed (3 hour)

Dimensions

W x H	Stud center to center
1 1/2" x 7"	4 1/2"

Finishes

BHMA	Description	Substrate	Finish
600	Primed for Paint	Steel	USP
630	Satin Stainless	Stainless steel	US32D

For other colors, consult factory.

Available accessories

- Security pin fasteners

LG14



Lock guard - with electric strike

- Narrow design unit for use on rose or escutcheon 3 1/2" or less
- For use with Von Duprin 6210 and 6211 electric strike
- No exposed fasteners on face of unit
- Unique design provides maximum security, virtually eliminating the opening between door and frame at latch point
- Non-handed
- 4 welded mounting studs. No exposed fasteners on face of unit

Specifications

Material substrate	Made from 13 gauge stainless steel
Certifications	UL10C Listed (3 hour)

Dimensions

W x H	Stud center to center
2 9/16" x 9 1/2"	4 1/2" and 6 3/4"

Finish

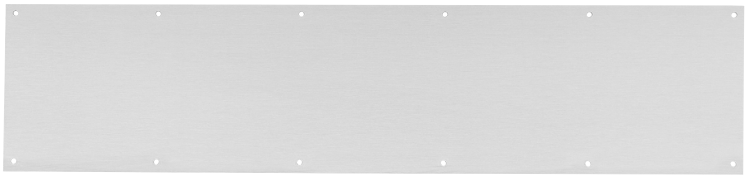
BHMA	Description	Substrate	Finish
630	Satin Stainless	Stainless steel	US32D

For other colors, consult factory.

Available accessories

- Security pin fasteners

8400/8402



Commercial protection plates (UL and non-UL models)

- All plates, metal and plastic, come standard with four beveled edges and countersunk mounting holes (B-CS)
- Protection plates must be ordered in 1/2" increments. Available in other sizes, consult customer service
- For 8402 UL Plates, UL mark appears in upper left corner. Not available on plastic protection plates (special cutouts are not allowed on UL kick plates)

Specifications

Material substrate	▪ Available in .050" thick brass, stainless steel or aluminum; and 1/8" thick high impact polyethylene in clear or black ▪ Aluminum 5005 Series, brass C26800 Series, stainless steel 300 Series, plastic
Mounting hardware	▪ Standard mounting package, 16 per pack – #6 x 5/8 Oval head screws ▪ Optional Tek/Torx package, specify TK-TX – #6 x 5/8 Self-drilling, self-tapping screws – #6 x 5/8 Torx screws
Certifications	▪ Meets ANSI/BHMA A156.6 for J301 ▪ UL protection plates certified to UL10C

Number of screw packs required by plate size (specify Tek screws or Torx screws)

	22"-25"	26"-33"	34"-41"	42"-48"
4"-8"	1	1	1	1
9"-16"	1	1	1	1
17"-24"	1	1	1	2
25"-32"	1	1	2	2
33"-40"	1	2	2	2
41"-48"	2	2	2	2

Options

- Specify B-NH for no mounting holes (Not available on 8402. Available only with US32D, US32, US3, US4, US28, CLR, P-BLK only)
- Specify B-NHA for no mounting holes with adhesive (Not available on 8402.)
- Specify ERS prepped with extra row of screws
- Special Cut-outs are available as engineering special, consult customer service

Finishes

BHMA	Description	Substrate	Finish	Max sizes
605	Bright Brass	Brass	US3	24" x 48"
606	Satin Brass	Brass	US4	24" x 48"
612	Satin Bronze	Brass	US10	24" x 48"
613	Oil Rubbed Bronze	Brass	US10B	36" X 46"
619	Satin Nickel	Stainless	US15	24" x 48"
625	Bright Chrome	Stainless	US26	48" X 48"
626	Satin Chrome	Brass	US26D	30" x 36"
628	Satin Aluminum	Aluminum	US28	48" x 48"
629	Bright Stainless Steel	Stainless steel	US32	48" x 48"
630	Satin Stainless Steel	Stainless steel	US32D	48" x 48"
654	Satin Stainless Steel	Stainless steel	US32D	48" x 48"
695	Dark Bronze Powder Coat	Stainless steel	SP313/US10BE	24" x 48"
BLK	Matte Black	Stainless steel	BLK	24" x 48"
P-BLK	Black	Plastic	P-BLK	48" x 48"
CLR	Clear	Plastic	CLR	48" x 48"

Custom finishes are available as engineering special, consult customer service

Available accessories

- Gasket tape kit tape is recommended when using a brass plate on a metal door to reduce tarnishing from electrolytic oxidation
- One tape pack will cover an the perimeters of a 8" x 34" kickplate (Order 8401 gasket tape)

FS436/FS438

Dome stop

- FS436 for doors without threshold
- FS438 for doors with threshold or undercut doors
- Heavy-duty cast dome stops
- Packed with fasteners for light duty masonry and wood applications
- Grey rubber bumper



FS436



FS438

Specifications

Material substrate	Made from cast brass or aluminum
Certifications	▪ FS436 Meets ANSI/BHMA A156.16, L12141 for brass and L32141 for aluminum ▪ FS438 Meets ANSI/BHMA A156.16, L12161 for brass and L32161 for aluminum

Dimensions - FS436

Overall height	Base height	Base diameter
1"	3/16"	1 3/4"x 2" oval

Dimensions - FS438

Overall height	Base height	Base diameter
1 3/8"	9/16"	1 3/4"x 2" oval

Finishes - brass

BHMA	Description	Substrate	Finish
605	Bright Brass	Brass	US3
606	Satin Brass	Brass	US4
609	Blackened Brass	Brass	US5
612	Satin Bronze	Brass	US10
613	Oil Rubbed Bronze	Brass	US10B
619	Satin Nickel	Brass	US15
622	Matte Black	Brass	BLK
625	Bright Chrome	Brass	US26
626	Satin Chrome	Brass	US26D
–	Aged Bronze	Brass	643e/716

Finish - aluminum

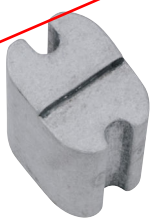
BHMA	Description	Substrate	Finish
628	Satin Aluminum	Aluminum	US28

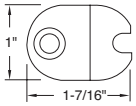
For other colors, consult factory.

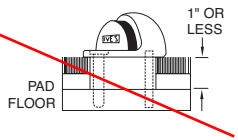
R435/R437

Dome stop riser

- R435 for conversion of FS436 Dome stop to carpet installation
- R437 For conversion of FS438 Dome stop to carpet installation
- Packed with fasteners for heavy duty masonry and wood applications







Specifications

Material substrate	Made from aluminum, mill finish

Dimensions

Base diameter	Heights available
1"x 1 7/16" oval	1/4", 3/8", 1/2" 5/8", 3/4" and 1" heights

FS18S / FS18L

Floor stop

- FS18S - 1 1/2", FS18L - 3 1/2"
- Security door stops designed for use in high vandalism areas
- Molded from black flame resistant, resilient material around a heavy-duty stud
- Once grouted in concrete, leaves no exposed fasteners to be tampered with or removed
- Ideal for jail or security cell areas where floor mounted stops are required
- FS18L also ideal for concrete wall applications

Specifications

Material substrate	Made from rubber

Finishes

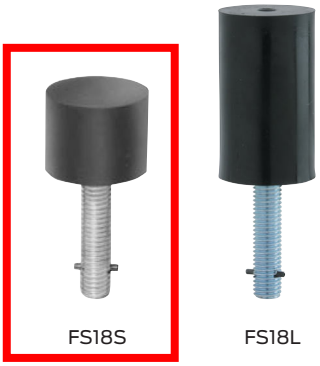
- Black rubber

Dimensions - FS18S

Height	Diameter	Stud length
1 1/2"	2"	2 1/2"

Dimensions - FS18L

Height	Diameter	Stud length
3 1/2"	2"	2 1/2"



FS434

Floor stop

- For undercut doors up to 1 1/2"
- Packed with fasteners for light duty masonry and wood applications
- Soft, resilient black rubber

Specifications

Material substrate	Made from wrought steel

Dimensions

Overall height	Base size
2 5/8"	1 1/2" W x 2 3/4" L

Finish

BHMA	Description	Substrate	Finish
604	Zinc Plated	Steel	US2C



Available accessories

- Replaceable soft, resilient black rubber

430

Floor door stop

- For undercut doors up to 1 1/2"
- Welded wood screws for wood applications
- White rubber tip

Specifications

Material substrate	Made from cast brass and aluminum

Dimensions

Overall height	Base size
2 5/8"	1 1/2" W x 2 3/4" L



Finishes - brass

BHMA	Description	Substrate	Finish
605	Bright Brass	Brass	US3
606	Satin Brass	Brass	US4
609	Blackened Brass	Brass	US5
613	Oil Rubbed Bronze	Brass	US10B
619	Satin Nickel	Brass	US15
625	Bright Chrome	Brass	US26
626	Satin Chrome	Brass	US26D

Finishes - aluminum

BHMA	Description	Substrate	Finish
666	Bright Brass	Aluminum	A3
–	Blackened Brass	Aluminum	A5
669	Bright Nickel	Aluminum	A14
673	Aluminum Clear Coat	Aluminum	A92

For other colors, consult factory.

Available accessories

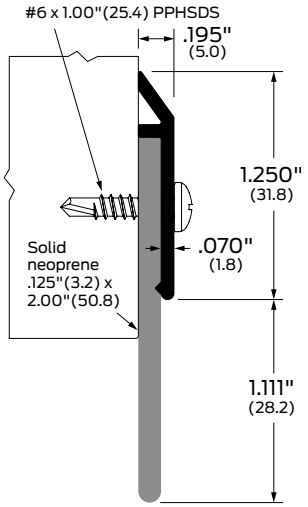
- Replaceable white or black rubber tips

Gasketing

Door Sweeps: Synthetic Rubber Blend

39W

Zero Preferred



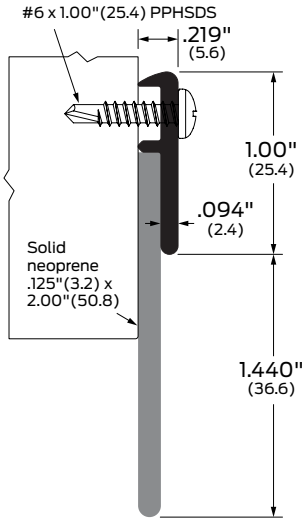
Finishes:
Aluminum mill finish; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized

Option:
SEC

Certifications:
BHMA CERTIFIED 10C

339W

Zero Preferred



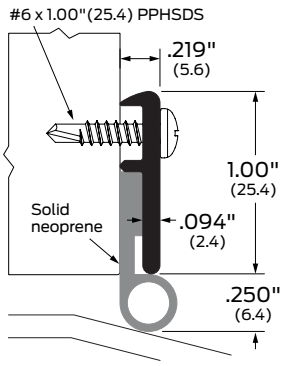
Finishes:
Aluminum clear anodized; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized; Bronze, architectural mill finish; Oil-rubbed aged bronze

Option:
SEC

Certifications:
BHMA CERTIFIED 10C

328

Zero Preferred



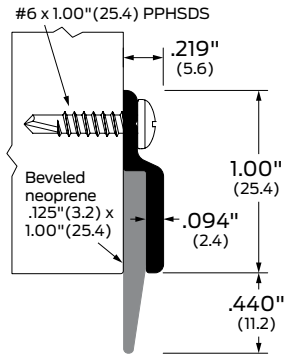
Finishes:
Aluminum clear anodized; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized; Bronze, architectural mill finish; Oil-rubbed aged bronze

Option:
SEC

Certifications:
BHMA CERTIFIED 10C

50M

Zero Preferred



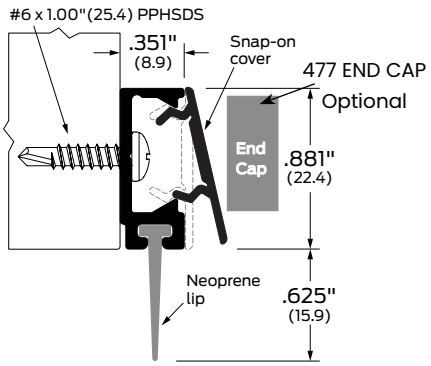
Finishes:
Aluminum clear anodized; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized

Option:
SEC

Certifications:
BHMA CERTIFIED 10C

477

Zero Preferred



Optional 477 END CAP can be ordered separately for a clean look on edges. Specify End Cap option for a clean look on edges.

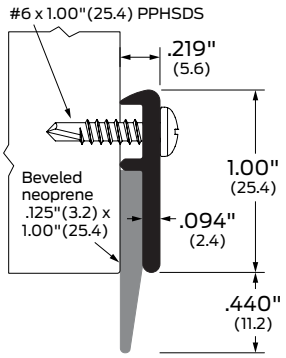
Finishes:
Aluminum clear anodized; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized

Option:
SEC, End Cap

Certifications:
BHMA CERTIFIED 10C

329

Zero Preferred



Finishes:
Aluminum clear anodized; Aluminum black anodized; Aluminum dark bronze anodized; Aluminum gold anodized; Bronze, architectural mill finish; Oil-rubbed aged bronze

Option:
SEC

Certifications:
BHMA CERTIFIED 10C

2720 Tobey Drive, Indianapolis, IN 46219
Tel 1-877-671-7011 ▪ Fax 800-851-0000
Zero.Customer.Support@allegion.com
www.zerointernational.com

Part No: 488S

Part description: Self-adhesive weatherstripping

Notes:

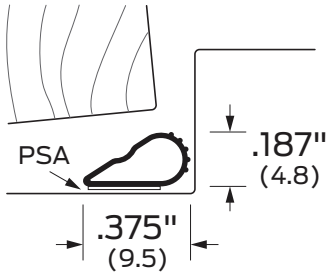
Provided by:

Customer name:

Job no:

Date:

Image may not be shown to scale



Notes:
PSA standard.

Certifications:

- Fire rated-UL10c
- Smoke and draft control

ANSI/BHMA:

488S R0E154

BHMA CERTIFIED

Finishes:

BK	Black
BR	Brown
CL	Clear
GY	Gray
WH	White

Options:

ZAG	Ligature resistant gasketing

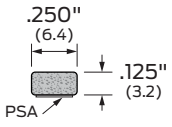
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Self-Adhesive Weatherstripping

Sponge Synthetic Rubber Blend Models

8172N

Zero Preferred



PSA standard

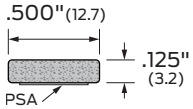
Finishes:
Black

Option:
ZAG, PSA

Certifications:
BHMA CERTIFIED 10C

8770N

Zero Preferred



PSA standard

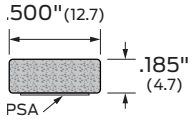
Finishes:
Black

Option:
ZAG, PSA

Certifications:
BHMA CERTIFIED 10C

312N

Zero Preferred



PSA standard

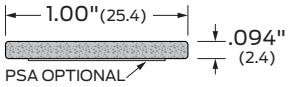
Finishes:
Black

Option:
ZAG, PSA

Certifications:
BHMA CERTIFIED 10C

8780N

Zero Preferred



Mullion seal

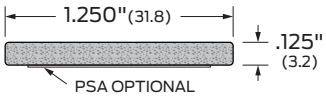
Finishes:
Black

Option:
ZAG, PSA

Certifications:
BHMA CERTIFIED 10C

139N

Zero Preferred



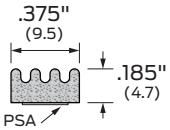
Finishes:
Black

Option:
ZAG, PSA

Certifications:
10C

926N

Zero Preferred



PSA standard

Finishes:
Black

Option:
ZAG, PSA

Certifications:
BHMA CERTIFIED 10C

Architectural Door Accessories

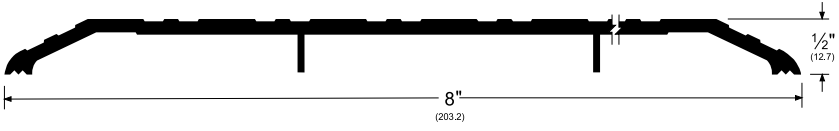
ASSA ABLOY

Pemko Commercial Thresholds: Saddle Thresholds

The global leader in door opening solutions

2548_

AVAILABLE FINISHES: **A, D**
WIDTH: **8" (203.2 mm)**
HEIGHT: **1/2" (12.7 mm)**



A (Mill Finish Aluminum)
D (Dark Bronze Anodized)

TITLE:
PREPARED FOR:
PREPARED BY:
DATE:
COMMENTS:

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CUT SHEET

PEMKO
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Experience a safer
and more open world

PEMKO DOOR BOTTOMS

Door Shoes

2221_V

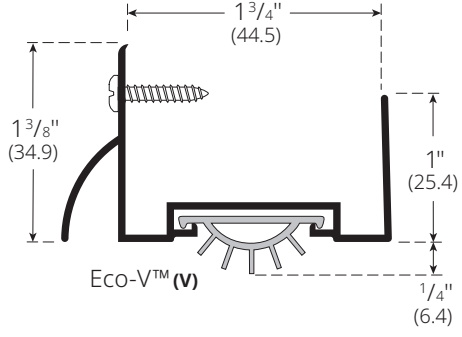
AVAILABLE FINISHES:
A, BSP, D, G, WSP

WIDTH:
1 3/4" (44.5 mm)

PROFILE HEIGHT 1:
1 3/8" (34.9 mm)

PROFILE HEIGHT 2:
1" (25.4 mm)

TOTAL HEIGHT WITH INSERT:
1 5/8" (41.3 mm)



A (Mill Finish Aluminum)
BSP (Black Suede Powder Coat)
D (Dark Bronze Anodized Aluminum)
G (Gold Powder Coat)
WSP (White Suede Powder Coat)

TITLE:
PREPARED FOR:
PREPARED BY:
DATE:
COMMENTS:

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Architectural Door Accessories

ASSA ABLOY

Pemko Door Bottoms: Door Top Weatherstrip

The global leader in door opening solutions

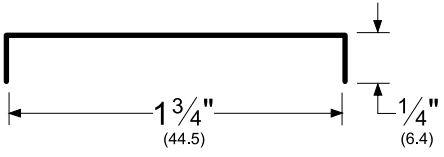
_344

AVAILABLE FINISHES: **B, PA**

AVAILABLE LENGTHS: **36", 48"**

WIDTH: **1-3/4" (44.5 mm)**

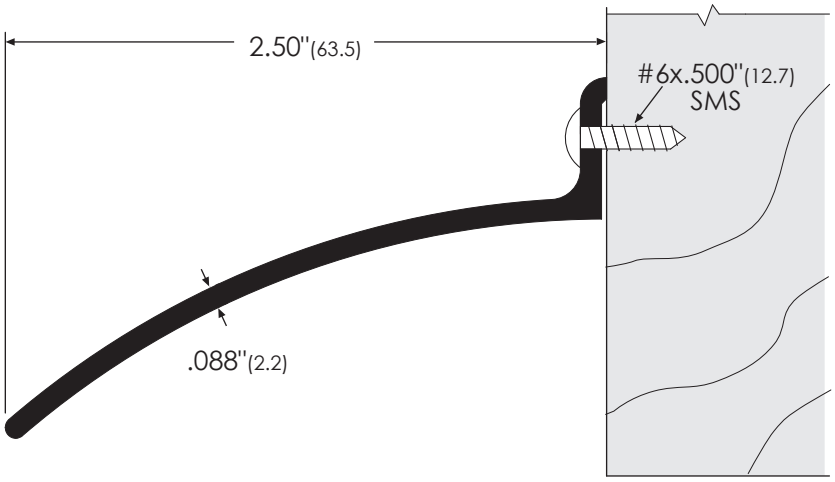
HEIGHT: **1/4" (6.4 mm)**



B (Mill Finish Extruded Bronze [Brass])
PA (Painted Aluminum)

TITLE:
PREPARED FOR:
PREPARED BY:
DATE:
COMMENTS:

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Legend:
A = Aluminum

ANSI/BHMA

#142A	R3Y976

ZERO INTERNATIONAL

415 Concord Avenue
Bronx, NY 10455
tel: 718.585.3230
fax: 718.292.2243
email: zero@zerointernational.com
web site: www.zerointernational.com

Part No:
142

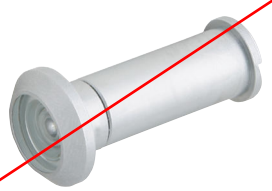
Notes:

Part Description:
Rain Drip
- Aluminum

Provided By:	Customer Name:	Job No:	Date:

Exterior hardware
Viewers

U696



One-way viewer - UL

- 150° angle of view
- For doors 1 3/8" to 2 1/16" thick
- Secure, tamper-resistant one-way thread installation
- Simple installation — only a 1/2" hole required
- Suggested installation height: 60" from floor

Specifications

Certifications
- Meets ANSI/BHMA A156.16, L23222
- UL10C Listed (90 min)

Dimensions

External diameter
3/4"

Finishes

BHMA	Description	Substrate	Finish
606	Satin Brass	Brass	B4
613	Oil Rubbed Bronze	Brass	B10B
619	Satin Nickel	Brass	B15
622	Matte Black	Brass	B-BLK
625	Bright Chrome	Brass	B26
626	Satin Chrome	Brass	B26D
–	Aged Bronze	Brass	B-643e/716

For other colors, consult factory.

Available accessories

- Trim washer available, 3/4" x .032" thick
- Extensions available for thicker doors
- Privacy viewer covers to prevent viewing from outside the room
- See available accessories details in the viewer covers/extensions section

698/U698



One-way wide angle viewer (UL and non UL models)

- 190° angle of view
- 4 optical glass lenses
- For doors 1 3/8" to 2 1/8" thick
- Simple installation — only a 9/16" hole required
- Suggested installation height: 60" from floor

Specifications

Certifications
- Meets ANSI/BHMA A156.16, L23222
- U698 is UL10C Listed (90 min)

Dimensions

External diameter	Lens projection
1"	1/4" from face of door

Finishes

BHMA	Description	Substrate	Finish
605	Bright brass	Brass	B3
619*	Satin nickel	Brass	B15
622*	Matte black	Brass	B-BLK
625*	Bright chrome	Brass	B26
626	Satin chrome	Brass	B26D
–	Aged bronze	Brass	B-643e/716

*Not available on 698. For other colors, consult factory.

Available accessories

- Extensions available for thicker doors
- Privacy viewer covers to prevent viewing from outside the room
- See available accessories details in the viewer covers/extensions section

SR64

Door silencer - metal



- For use on metal frames featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing
- Tamper-proof once installed on the frame
- Proper installation also eliminates door rattle and provides constant tension for door latches or locks
- Packed in bags of 100
- Grey also available in bulk pack of 2500
- Each bag has an installation tool included

Specifications

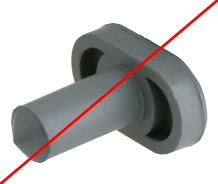
Material substrate	Made from 60 Durometer styrene butadiene rubber
Certifications	Meets ANSI/BHMA 156.16, L03011

Dimensions

Diameter	Projection
1/2"	1/8"

SR65

Door silencer - wood



- For use on wood frames, also feature pneumatic design to cushion shock and absorb noise
- To prevent removal, a small brad should be driven into stop strip and through stem of silencer, as shown in the detail
- Packed in bags of 100

Specifications

Material substrate	Made from 60 Durometer styrene butadiene rubber
Certifications	Meets ANSI/BHMA 156.16, L03021

Dimensions

Diameter	Width	Projection
3/4"	3/8"	1/8"

SR66

Door silencer - adhesive



- Self adhesive rubber silencers
- Economical installation requires no drilling of frames
- Packed two sheets of 50 (100 minimum)

Specifications

Material substrate	Made from 60 Durometer styrene butadiene rubber
Certifications	Meets ANSI/BHMA 156.16, L03021

Dimensions

Diameter	Projection
1/2"	1/8"

SR64, SR65 and SR66 Finishes

BHMA	Description	Substrate	Finish
–*	Brown	Rubber	BRN
–	Grey	Rubber	GRY
–*	White	Rubber	WHT

*Only available on SR66. For other colors, consult factory.

SECTION 08 80 00
GLAZING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Glass and glazing for storefronts, curtain walls, windows, and doors.
B. Resilient insulated infill panels
C. Spandrel glass panels.
D. Exterior Fire Rated Glazing.

1.02 RELATED SECTIONS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
B. Section 07 90 00: Joint Sealants.
C. Section 08 11 00: Metal Doors and Frames (for PM frame at window)
D. Section 08 14 16: Wood Doors.

1.03 REFERENCES

A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

B. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.

C. ASTM C920 - Elastomeric Joint Sealants.

D. ASTM C1036 - Flat Glass.

E. ASTM C1048 - Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

G. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness.

H. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

I. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.

J. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

1.04 SUBMITTALS

A. Submit under provisions of Section 00 72 00.

B. Product Data on Glass Types Specified: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special handling or installation requirements. Identify available colors.

D. Samples: Submit two samples, 12x12 inch in size, illustrating glass.

E. Samples: Submit 3 inch long bead of glazing sealant, color as selected.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual for glazing installation methods.

B. Installer's Qualifications: The installation shall be performed only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics who specialize in glazing and glass installation.

C. Safety glazing shall be identified in accordance with Section 2406.3, 2022 CBC, Title 24, Part 2 with identification etched in glass.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 48 hours after installation of glazing compounds.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop Drawings.

1.08 COORDINATION

A. Coordinate Work with glazing frames, wall openings, and adjacent Work.

PART 2 – PRODUCTS

2.01 GENERAL

A. All Glass shall be graded and meet requirements of ASTM C1036. Each light of glass delivered and installed shall have affixed thereto the manufacturer's grade label.

2.02 GLASS TYPES

A. **Type 1/4CT**: Clear Tempered Glass; ASTM C1048-85, Type 1, Class 1, Quality q3. Heat strengthened by manufacturer's standard process (after cutting to final size) to achieve a flexural strength 4 times normal glass strength; 1/4" thickness. All tempered glass shall have a permanent logo signifying compliance with the Consumer Product Safety Commission 16 CFR 1201 C1 and C11.

2.03 GLAZING COMPOUNDS

A. Glazing Sealants (non-sag type): Dow Corning 795, Tremco "Proglaze" or GE Silicone Sealants; Tremco "Mono" acrylic sealant.

B. Glazing Compound: Shall meet requirements of ASTM C669-00.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene EPDM blocks with a Shore A durometer hardness of 85, plus or minus 5 percent, chemically compatible with sealant used.

B. Spacer Shims: Neoprene, 50-60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 - 15 Shore A durometer hardness; coiled on release paper; black color; Tremco No. 440 tape.

D. Glazing Splines: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; black color.

E. Miscellaneous: Furnish all primers-sealers, setting blocks, shims, spacers, compression seals, etc., as required for a first class workmanlike job.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify prepared openings for adequacy to receive glass.

B. Verify that openings for glazing are correctly sized and within tolerance.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

D. Report in writing to, any conditions that may be detrimental to the Work.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Check that glass is free of edge damage or face imperfections.

3.03 INSTALLATION

A. General: Install glass types at locations indicated, according to glass manufacturer's recommendations and as specified herein.

B. Glass Glazing:

1. Positioning Glass: Orient pattern and draw of glass pieces in same direction. Set all sheet glass so that any waves, etc. are horizontal.
2. Do not cut, nip or abrade tempered glass.
3. Watershed: Gunnable sealants, when applied as a cap head, shall form a bevel or watershed away from the glass. When tape is used to the sightline, it shall form a watershed when compressed. Do not undercut a sealant, compound, or tape below the sightline. Tool and finish sealant as required. Use tooling solution recommended by the sealant manufacturer.
4. Positive Contact:

    a. When applying a heel bead, lap onto the glass a minimum of 3/16".

    b. When applying a toe bead, whether continuous or a corner seal, make certain it is large enough to contact both the glass and sash. Install the sealant prior to glass placement.

5. Setting blocks shall be 1/16" less than the full rabbet width, minimum length of 4" and high enough to provide the recommended minimum bite and edge clearance for the glass. Center blocks at 1/4 points unless otherwise recommended by the glass manufacturer.
6. Provide spacer-shims at a maximum of 24" o.c.
7. Clearances: Observe minimum face clearances, edge clearance and glass bite as recommended by the glass and sealant manufacturer.
8. Tape Installation: Do not install glazing tapes more than one day ahead of glass placement. Remove the paper backing from the tape only when the lite is ready to be installed. Do not stretch the tape to make it fit. Do not overlap the ends of the tape. Instead, butt ends together, and when corners are butted together, daub with sealant to assure a positive seal.
9. Glazing tapes must be kept under proper compression.
10. Glazing stops shall be installed so that stop or frame does not bear directly against glass.

3.04 CLEANING

A. Clean work under provisions of 00 72 00.

B. Remove glazing materials from finish surfaces.

C. Remove labels after work is complete.

D. Clean glass.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 00 72 00.

END OF SECTION

DOCUMENT 09 29 00

GYPSUM BOARD

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This Section includes gypsum board assemblies for the walls and ceilings.

1.02 RELATED SECTIONS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

B. Section 05 40 00 – Cold-Formed Metal Framing

C. Section 07 90 00 – Joint Sealants

D. Section 08 12 13 – Metal Frames

E. Section 09 91 00 – Painting

F. Section 10 01 25 – Tackable Surfaces

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 23 Shop Drawings, Product Data, and Samples. Submit product data.

B. Provide the Manufacturers' certification that products containing VOC's meet all local regulations controlling the use of VOC's.

1.04 QUALITY ASSURANCE

A. Comply with Federal Specification SS – L – 30b and ASTM C36.67.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, all products shall be from a single manufacturer from the following list:

1. Gypsum Board and Related Products:
   a. United States Gypsum Co.
   b. National Gypsum Co.; Gold Bond Building Products Division.

c. Georgia-Pacific Corp.
d. Or equal.

B. Gypsum board products: Types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Gypsum wallboard: ASTM C 36, in thickness indicated.
   a. Type: 5/8 inch thick.

C. Accessories for interior installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed metal or plastic, with metal complying with the following requirement:

1. Steel sheet zinc coated by hot-dip process or rolled zinc.
2. Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum, or rolled zinc.

D. Joint treatment materials: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the Manufacturer's of sheet products and of joint treatment materials for each application indicated.

1. Joint tape for gypsum board: Paper reinforcing tape, unless otherwise indicated.
   a. Use pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with compatible joint compound where recommended by Manufacturer of gypsum board and joint treatment materials for application indicated.

2. Setting-type joint compounds for gypsum board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   a. For prefilling gypsum board joints, use formulation recommended by gypsum board Manufacturer.
   b. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board Manufacturer.
   c. For topping compound, use sandable formulation.

3. Drying-type joint compounds for gypsum board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   a. Ready-mixed formulation: Factory-mixed product.
   b. Job-mixed formulation: Powder product for mixing with water at Project site.
      1) Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
      2) Topping compound formulated for fill (second) and finish (third) coats.
      3) All-purpose compound formulated for both taping and topping compounds.

E. Miscellaneous materials: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board Manufacturer.

1. Laminating adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
2. Spot grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.
3. Fastening adhesive for metal: Special adhesive recommended for laminating gypsum panels to steel framing.
4. Steel drill screws complying with ASTM C 1002 for the following applications:
   a. Fastening gypsum board to steel members less than 0.033 inches thick.
   b. Fastening gypsum board to wood members.
   c. Fastening gypsum board to gypsum board.
5. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inches thick.
6. Foam gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.

PART 3 – EXECUTION

3.01 GYPSUM BOARD APPLICATION AND FINISHING STANDARDS

A. Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

1. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on 1 side.
2. Grout hollow metal doorframes.
3. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
4. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4 to 1/2 inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
5. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and Manufacturer's recommendations.
6. Space screws a maximum of 12 inches on center for vertical applications.
7. Space fasteners in panels that are tile substrates a maximum of 8 inches on center.

3.02 DIRECT-BONDING TO SUBSTRATE

A. Where gypsum panels are indicated as directly adhered to a substrate other than studs, joists, furring members, or base layer of gypsum board, comply with gypsum board Manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.03 INSTALLING TRIM ACCESSORIES

A. For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory Manufacturer's directions for type, length, and spacing of fasteners.

1. Install cornerbead at external corners.
2. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
    a. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
    b. Install L-bead where edge trim can only be installed after gypsum panels are installed.
    c. Install U-bead where indicated.
    d. Install aluminum trim and other accessories where indicated.
    e. Install control joints at locations indicated.
    f. Install control joints according to ASTM C 840 and Manufacturer's recommendations and in specific locations approved by University's Representative for visual effect.

3.04 FINISHING GYPSUM BOARD ASSEMBLIES

A. Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

1. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
2. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
3. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory Manufacturer.
4. Allowable Tolerances: Deviation from plumb or level shall not exceed 1/8 inch within 10 feet in any direction, as determined with a 10 foot straight edge.
5. Finish gypsum board to a Level 4 with light orange peel finish per the Gypsum Association.

END OF SECTION

Section 09 65 19

Resilient Tile Flooring

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Sacramento County Standard Specification and Contract apply to the work of this section.

1.03 RELATED SECTIONS

A. Other Division 9 sections for floor finishes related to this section but not the work of this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Select an installer who is competent in the installation of solid vinyl flooring with acrylic adhesive or two part epoxy.

B. Provide resilient flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

C. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
   1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
   2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.05 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of "Mannington’s Professional Installation Guide,") for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

C. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.06 ENVIRONMENTAL CONDITIONS

A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened

containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF (18ºC) and a maximum temperature of 85ºF (29ºC) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55ºF (13ºC) and a maximum temperature of 85ºF (29ºC) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating appliances.

D. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 PRODUCTS

2.01 RESILIENT FLOORING MATERIALS –
A. Basis of Design:Tarkett, LVT ID Lattitude, Fine Lines Greige LW PLFL 5102 6”x36”

A. Specifications:
1. Construction - Luxury Vinyl Tile & Plank, Non-ortho phthalate
2. Overall Thickness – 0.120 inches (3.0 mm)
3. Wearlayer Thickness – 20 mil (0.51 mm)
4. Finish Layer – Techtonic
5. Edge Treatment – Square Edgel
6. Sizes: 6” x 36”
7. Specification (ASTM F-1700) - Class III, Type B

B. Warranty: Limited 20 Year Warranty

2.02 ADHESIVES

A. Manufacturer’s recommended adhesive.

2.04 ACCESSORIES

A. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

B. Provide transition/reducing strips tapered to meet abutting materials.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Portland Cement-Based Underlayment as recommended by the flooring manufacturer
.

B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds. Avoid organic solvents.

C. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.03 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with "Mannington’s Professional Installation Guide" and any other product specific published installation instructions.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

D. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.04 INSTALLATION OF ACCESSORIES

A. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

B. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

C. Apply overlap edge strips where shown on the drawings. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.05 CLEANING AND PROTECTION

A. Perform initial maintenance according to the latest edition of the manufacturer’s maintenance and warranty literature. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

B. Do not wax, polish, seal or apply other finishes to the installed flooring unless specifically directed by end user.

END OF SECTION

SECTION 09 65 16

RESILIENT FLOORING – SHEET VINYL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 09 29 00 – Gypsum Board.

1.02 REFERENCES

A. Manufacturer's flooring technical manuals.

B. ASTM International:

1. ASTM E648-25 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
2. ASTM E662-21ae1 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
3. ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. ASTM F1482-21, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
5. ASTM F1861-21(2025) Standard Specification for Resilient Wall Base
6. ASTM F1869-23 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
7. ASTM F1913-19(2025) Standard Specification for Vinyl Sheet Floor Covering Without Backing
8. ASTM F2170-19a Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
9. ASTM D2047-25 Standard for Slip-resistance: Minimum coefficient of friction 0.6

C. National Fire Protection Association (NFPA):

1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid

Materials

D. Standards Council of Canada

1. CAN/ULC-S102.2 Standard Test Method for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.

B. Administrative Requirements

1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions and manufacturer’s warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e., moisture tests, bond test, pH test, etc.)

1.04 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation, and maintenance instructions for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.

C. Submit Safety Data Sheets (SDS) available for adhesives, weld rod, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.

D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

E. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein

1.04 QUALITY ASSURANCE

A. Qualifications of Installer: Minimum five (5) years' experience in successfully installing the specified products or similar flooring materials.

B. Comply with the following as a minimum requirement:

1. Materials shall be compliant with requirements of CBC Chapter 11B and ADAAG.
2. ASTM E84: Class A Flame Spread Rating of 25 or less.
3. Fire Test Data: ASTM E648-25, NFPA 253, ASTM E662-21ae1, NFPA 258.
4. Moisture Testing: ASTM F1869-23.
5. ASTM E662-21ae1 (Smoke Generation) Maximum Specific Optical Density of 450 or less
6. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.05 DELIVERY, STORAGE AND HANDLING

A. Comply with Division 1 Product Requirements Sections

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.06 PROJECT CONDITIONS

A. Ventilation and Temperature: Verify areas that are to receive new flooring are ventilated to remove fumes from installation materials, and areas are within temperature range recommended by the various material manufactures for project site installation conditions, through completion of project.

B. Install resilient products after other finishing operations, including painting, have been completed.

1.07 WARRANTY

A. Manufacturer shall provide ten (10) year material warranty, minimum.

B. Installer shall provide a two (2) year fabrication and installation warranty.

1.08 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and

identified with appropriate labels.

1. Quantity: Furnish quantity of flooring units equal to 5% of amount installed
2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra material.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A, Armstrong Flooring.

B. Tarkett Commercial.

C. Or Approved Equal.

2.02 MATERIALS

A. Homogeneous Sheet Flooring

1. Description: An unbacked, nonlayered, homogeneous sheet vinyl flooring. Protected by a diamond-infused UV-cured polyurethane finish, the colors and pattern detail are dispersed uniformly throughout the thickness of the product. Color pigments are insoluble in water and resistant to cleaning agents and light.
2. Homogeneous sheet flooring shall conform to the requirements of ASTM F1913-19 Standard Specification for Sheet Floor Covering Without Backing
3. Pattern and Color: See finish schedule in drawings.
4. Width: Per manufacturer.
5. Length: Per manufacturer.
6. Thickness: 0.080 in. (2.0 mm)

C. Weld Rod:

1. Provide solid color vinyl weld rod as produced by manufacturer and intended for heat welding of seams. Color shall be compatible with field color of flooring or as selected by Architect to contrast with field color of flooring. Color selected from the range currently available from manufacturer.

D. Seam Adhesive:

1. Provide Seam Adhesive at seams as recommended by the resilient flooring manufacturer.

E. Integral Flash Cove Base:

1. Provide integral flash cove wall base by extending sheet flooring (New Construction, non-toilet room or food service - 4 in. high, Modernization-type projects, new cafeteria spaces, and toilet

rooms -6 in. high) up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.

G. Resilient Edge and Adapter/Transition Strips: 1/8-inch-thick, tapered or bullnose, minimum of 1 inch wide.

1. Roppe
2. Johnsonite
3. Flexco Floors
4. Approved equal.

H. Leveling and Patching Compounds:

1. Portland cement-based patch recommended by carpet manufacturer. Install as recommended by manufacturer for specific application.

I. Concrete Primer: Non-staining type recommended by manufacturer of resilient sheet vinyl flooring.

J. Trim: Stainless steel or extruded aluminum top trim and ¾ inch radius plastic fillets with integral cove base.

K. Floor Sealer: Install as recommended by manufacturer for specific application.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate with related Work to assure level, smooth, and clean finish surfaces to receive floor tile.

3.02 COMPLIANCE

A. Comply with manufacturer’s product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e., moisture tests, bond test, pH test).

B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

3.03 PREPARATION

A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with leveling compound as recommended by the flooring manufacturer. Refer to the product installation recommendations and ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

B. Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects as recommended by the flooring manufacturer. Refer to the product installation recommendations and ASTM F710-22 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

C. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers, and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate, they must be mechanically removed prior to the installation of the flooring material. Refer to the product installation recommendations and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

D. When using certain adhesives, perform subfloor moisture testing in accordance with ASTM F2170-19a, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes” and Bond Tests as described by manufacturer to determine if surfaces are dry; free of

curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. The internal relative humidity of the concrete shall not exceed 95%. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until the results of moisture tests are acceptable. All test results shall be documented and retained.

E. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.04 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the latest edition of the flooring installation recommendations. Failure to comply may result in voiding the manufacturer’s warranty listed in Section 1.08.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.

F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.

G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

H. Prepare heat-welded seams with methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

I. Provide integral flash cove wall base where shown on the drawings, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. Heat-weld seams or use seam adhesive as specified for those on the floor.

3.05 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

D. Apply metal edge strips where shown on the drawings, during flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.06 CLEANING

A. Perform initial and on-going maintenance according to the latest edition of the maintenance recommendations from manufacturer.

3.07 PROTECTION

A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION

SECTION 09 68 00

CARPET

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Broadloom and carpet tile.
2. Base finish and accessories
3. Subfloor testing and preparation.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 00 72 00: Exhibit C: Abatement of Hazardous Materials.
3. Section 09 29 00: Gypsum Board Systems: Wall materials to receive base.
4. Section 09 65 00: Resilient Flooring - LVT.
5. Section 09 65 16: Resilient Flooring – Sheet Vinyl.

1.02 REFERENCES

A. ANSI/ASTM E648-25 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F1869-23 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.03 QUALITY ASSURANCE

A. Manufacturer, Contractor, and Installer Qualifications:

1. Manufacturer: Company specializing in contract flooring with ten years minimum experience.
2. Flooring Contractor: Company with five years' minimum documented experience, approved by manufacturer for the installation of the specified products and shall have access to all manufacturers required technical, maintenance, specifications and related documents.
3. Installer:
   a. Floor covering installer must be factory trained and certified for the installation of the specific products being installed.

   b. Installer to provide project inspector proof of certification prior to starting work.
   c. Certified installer must be present on job site while work is in progress.

4. Testing Laboratory:
   a. Certified, bonded, qualified and experienced agency to perform pH and Relative Humidity (RH) emission tests.

B. Pre-Floor Covering Installation Meeting:

1. Contactor to notify Construction Manager with a minimum of 5-days' notice when anticipated to be ready for pre-floor covering installation meeting. (After subfloor preparation is complete and ready for floor covering installation.)
2. Contractor, installer, and manufacturer representative are required to attend pre-floor covering meeting. Contractor is responsible for coordinating and scheduling their attendance.
3. Construction Manager will schedule meeting with Contractor team, Project Inspector, and Architect.
4. Purpose of Meeting: To review subfloor preparation, verification of readiness for floor covering installation and use of correct products, verification of the acclamation of correct finish materials and review installation requirements.

C. Manufacturer's Field Services:

1. Manufacturer representative to attend the "Pre-Flooring" meeting.
2. Upon Owner or Architect's request, and with at least 72-hour notice, provide manufacturer's representative site visit(s) for inspection of product installation.
3. At the Owner's request, manufacturer representative to attend operation and maintenance training meeting for Owner's custodial staff prior to acceptance of floor covering installation.

1.04 SUBMITTALS

A. Provide a complete submittal package with all components required within this section. Submit per Section 01 33 00.

1. Product Data: Provide product data describing physical and performance characteristics, sizes, patterns, colors, material safety data sheets, and method of seaming and manufacture's installation instructions for all proposed products.

2. Shop Drawings:
   a. Provide a floor plan indicating all proposed seam locations and integrated walk-off mats. Indicate method of joining seams, and direction of carpet.

3. Samples:
   a. Submit samples for color selection illustrating color and pattern for floor material with samples of matching walk-off mats, rubber base and transition material proposed for installation.
   b. Submit sample of solvent welded seam.
4. Maintenance Data: Submit manufacturers recommend cleaning and maintenance data. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
5. Recycled Content Percentage Submittals

6. Submit a statement signed by the manufacturer's Executive Officer or independent certification third-party that the provided carpet materials have the specified recycled material percentage.
7. Submit documentation of manufacturer's take-back program for carpet. Including:
   a. Confirmation that the new carpet being installed will be accepted (at the point of future replacement) through a manufacturer's operated program for recycling or reuse;
   b. Written description of such a process for the recycling and/or recovery of used/worn products;
   c. Contact information for the take-back program.
8. Existing Carpet Recycling Plan and Recycling Certification. Submit documentation describing the reclamation plan for existing carpet. Include appropriate contact information, overview of procedures, and limitations and conditions applicable to the project Carpet recycling options consist of:
   1. Repurposing - reusing the product in another application such as facilitating the donation of used carpeting to charities and other nonprofit organizations.
   2. Closed Loop Recycling - turning waste materials into new materials of the same value, such as vinyl backing into vinyl backing and nylon yarn into nylon carpet yarn.
   3. Open Loop Recycling – creating other product types from reclaimed carpet. For example, turning nylon face fiber into automotive parts or carpet padding, including nylon face fiber in recycled backings
   4. Waste-to-Energy - using carpet for waste-to-energy. In the case of waste-to-energy, manufacturer shall justify why carpet cannot be recycled as this method should be a last resort.
   5. Landfill or incineration – are not approved disposal methods
   6. At the completion of the project, a certificate shall be furnished verifying the reclamation of the carpet and the pounds of material diverted from the landfill.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit cleaning and maintenance data under provisions of Section 01 33 00.

B. Include maintenance procedures, recommended maintenance materials, and suggested schedule and products for cleaning.

C. Provide in-service training with Owner's custodial staff prior to acceptance of flooring for proper care and maintenance of carpet. Also review and provide recommended type of furniture casters and glides.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected for exposure to harmful weather conditions and at a temperature and humidity conditions recommended by manufacturer. Materials should be stored in areas that are fully enclosed, weather tight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hours prior to, during and after installation.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain minimum 70 F ambient temperature at floor level three days prior to, during, and 24 hours after installation of materials.

C. Prior to testing for moisture vapor emission rate, space shall be enclosed, fully weather-tight, wet-work in space shall be completed and nominally dry, work above ceilings finished. The test site should be at the same temperature and humidity expected during normal use.

D. Maintain lighting at a minimum uniform level of 50 or more-foot candles in areas where the floor system is being installed.

E. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

F. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants.

G. Floor temperature should be 60 °F minimum for proper adhesive curing and performance.

H. If subfloor is contaminated with an oily residue either from removal of “cutback” during asbestos abatement or from a previous end use such as metal fabrication, this residue MUST be totally removed or covered prior to applying modular adhesive and carpet.

1.08 CONCRETE SUBFLOOR TESTING

A. Testing for internal relative humidity of concrete slabs must be conducted in accordance with the current version of ASTM F2170-19a, not to exceed manufacturer’s requirements (ASTM F2170-19a – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes).

B. The Flooring Contractor shall verify in writing to the Owner, a minimum of thirty (30) days prior to scheduled carpet installation, the following substrate conditions:

1. Moisture: Initial emission rate, as tested with in-situ probes, per ASTM F2170-19a.
2. Alkalinity: pH level. Testing the pH at the surface of a concrete slab must be conducted in accordance with the current version of ASTM F710, not to exceed manufacturer’s requirements (ASTM F710-19a – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.)

C. High Moisture and /or Alkalinity Readings:

1. Modernization Construction (Existing Concrete Slab)

a. If the Contractor's test results indicate that the slab relative humidity (RH) readings are below those of flooring manufacturer's requirement, then the Owner's representative will initiate independent testing to confirm results.
   1) If the independent test results do not substantiate the Contractor's findings, then the Contractor will be directed to proceed with the Vapor Retarder installation and the retesting cost will be back charged to the contractor.
   2) If the independent test results confirm the Contractor's findings, then the Contractor shall initiate a credit to the Owner for the cost of installation of the Vapor Retarders as specified in section 07 26 00 that were not installed.

D. Comply with manufacturer's written requisites for field conditions including but not limited to testing for moisture, confirmation of vapor retarder, floor prep, bond test, photo documentation, etc.

1.09 EXTRA MATERIALS

A. Provide a minimum of 4 square yards of each color installed. In addition, provide all usable scraps one sq. yd. or larger in size. Remnants shall be packaged, identified and delivered to the Owners' Representative, who will retain any he chooses for future repairs before they are removed from the job site.

B. Provide a minimum of 10 lineal feet of base and transition pieces of each material and color specified or 2 % whichever is greater.

1.10 WARRANTY

A. Manufacturer's Warranty: Twenty (20) year minimum manufacturer warranty commencing on recordation date of the Notice of Completion.

1. Should carpet, tend to creep, bulge, be defective in manufacturing, or show a substantial amount of wear - carpet shall be replaced with new carpeting at no cost to the Owner. Manufacturer to submit written warranty covering the following:
   a. 20 Year minimum, non-prorated Guarantee shall also include:
      1) No resiliency loss of backing.
      2) No zippering.
      3) Static protection (will not lose static property—will not give static discharge above 3.5KV).
      4) No edge ravel or zippering.
      5) Delamination.
      6) Surface wear (maintains at least 90% surface pile weight).
      7) No staining.
      8) Dimensional Stability.
      9) Moisture Resistance.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Carpet (Vinyl Cushioned Tufted Textile): Color as selected by Owner Representative from Manufacturer's standard range. No other substitutions will be allowed.

1. Tarkett Commercial – Hybrid resilient sheet flooring
   a. "Aftermath II" Series, 6'-0" roll, glue down. Powerbond cushion RS vinyl backing system and seam sealer.
   b. Or Equal.

B. Rubber Wall Base: Cove style, conforming to ASTM F 1861 or FS-SS-W-40, Type 1. Modernization-type projects 6" high and 1/8-inch (3.2mm) gauge. No manufactured corners. Install from roll.

1. Burke Industries.
2. Armstrong.
3. Musson Rubber Co.
4. Roppe Rubber Corp.
5. Approved equal.

C. Resilient Edge and Adapter/Transition Strips: 1/8-inch-thick, tapered or bullnose, minimum of 1 inch wide.

1. Roppe
2. Johnsonite
3. Flexco Floors
4. Approved equal.

D. Leveling and Patching Compounds:

1. Portland cement-based patch recommended by carpet manufacturer. Install as recommended by manufacturer for specific application.

E. Primer:

1. Tarkett Commercial: C-36E primer.
2. Milliken: None required.

F. Adhesives: Low VOC, waterproof, and as recommended by product manufacturer.

1. Tarkett "RS" pre applied microencapsulated tackifier.
2. Tarkett Commercial: C-16E Powerbond Adhesive.
3. Milliken: Mosaic Moisture XT Spray.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Modernization Construction (Existing Concrete Slab)

1. If existing flooring was determined to be asbestos containing and required abatement, verify that the abatement work has been accepted by the Owner's representative prior to commencing work.
2. Testing for internal relative humidity of concrete slabs must be conducted in accordance with the current version of ASTM F2170-19a, not to exceed manufacturer's requirements (ASTM F2170-19a – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes).

3.02 PREPARATION

A. Modernization Construction (Existing Concrete Slab)

1. Remove existing finishes, adhesives, and other materials as necessary to properly prepare existing substrates. (Refer to asbestos abatement procedures.)
2. Install underlayment where flooring is being installed on a wooden subfloor per the manufacturer's instructions.
3. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
4. Fill low spots, cracks, joints, holes and other defects with filler prior to flooring installation.
5. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
6. Prohibit traffic from area until filler is cured.
7. Prepare floor substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as dirt, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue. Vacuum clean substrate.
8. Apply primer to concrete surfaces.

3.03 CARPET INSTALLATION

A. Install in accordance with manufacturers' instructions and recommendations with fully welded seams.

B. Install flooring square with room axis and in accordance with approved shop drawing.

C. Layout roll-goods in a manner to minimize seams and avoid seams in traffic areas. End butt joints shall be kept to a minimum, shall be staggered, and shall occur where approved on detail plan layout. Use the largest sections possible to minimize seams. Avoid cross seams, filler pieces and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer recommendations.

D. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

E. Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including pipes, outlets, edgings, thresholds, nosing and cabinets.

F. Install edge strips at unprotected or exposed edges, and where flooring terminates.

G. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.

H. Adhere carpet to prepared substrate without producing open cracks, voids, raising and puckering at joints, telegraphing to adhesive spreader marks, or other surface imperfections in completed installation.

I. Fully solvent weld all seams. Seams shall be unnoticeable in finished installation.

J. Verify carpet match before cutting to ensure minimal variation between dye lots.

K. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed.

L. Lay carpet on floors with run of pile in same direction as anticipated traffic.

M. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.

N. Complete installation shall conform to the Carpet Installation Standard of Carpet and Rug Institute (CRI).

3.04 INSTALLATION - BASE MATERIAL

A. Install resilient wall base on entire wall perimeter including toe spaces and open ends of cabinets. Set all bases in adhesive as recommended by the manufacturer. All joints in bases shall be plumb, flush, tight and inconspicuous. Seat top edge and back of base firmly against the wall. Wrap base around all outside corners and no seams within 12” of corners. Interior corners shall be mitered and tightly fitted. Install from roll. Strips will not be accepted.

3.05 PROTECTION

A. Prohibit traffic from carpet areas for 24 hours after installation.

B. Protect flooring from damages by other trades prior to owner occupancy.

3.06 FINAL CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage. Remove and dispose of all small scraps, cartons, and rubbish upon completion of the work. Remove all loose threads with sharp scissors.

B. Clean carpet of all spots with proper spot remover, and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces, including mechanical and electrical equipment that do not have a factory-applied finish.

1.2 RELATED SECTIONS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

B. Section 08 11 00 – Metal Doors

C. Section 08 12 13 – Metal Frames.

D. Section 09 29 00.10 - Gypsum Board Assemblies

E. Division 23: Mechanical.

F. Division 26: Electrical.

1.3 REFERENCES

A. ASTM International (ASTM): ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

1.4 DEFINITIONS

A. General: Standard coating terms defined within Masters Painters Institute (MPI) manual.
   1. Gloss level 1 - Flat with a gloss range below 5 when measured at a 60-degree meter and 10 when measured at an 85-degree meter.
   2. Gloss level 2 - Low Sheen with a gloss range of 5 to 10 when measured at a 60 degree meter and 10 to 35 when measured at an 85 degree meter.
   3. Gloss level 3 - Eggshell with a gloss range between 10 and 15 when measured at a 60-degree meter and 10 to 35 when measured at an 85-degree meter.
   4. Gloss level 4 - Satin with a gloss range between 25 to 35 when measured with a 60 degree meter.
   5. Gloss level 5 - Semi-Gloss with a gloss range between 50 and 55 when measured at a 60 degree meter.
   6. Gloss level 6 - Gloss with a gloss range more than 70 when measured at a 60 degree meter.

1.5 SUBMITTALS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

D. At project completion, provide floorplans and elevations denoting all colors used on project with descriptive notations for color and sheen. Each paint color shall be labeled P1, P2, P3, etc. Provide a legend identifying all paint colors. Legend shall also match the final draw downs of each color.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint Exposed Surfaces: If an item or a surface is not specifically mentioned, paint the item, or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

D. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C), unless manufacturer's instructions specifically states.

E. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

F. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Dunn Edwards Paints.

2.2 PAINT MATERIALS – GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide materials, including primers, undercoats, and finish-coat materials, which meet local air quality management district regulations.

C. Color: Refer to Finish Schedule for paint colors.

D. Application Rate: Coating thickness for primer, intermediate, barrier and finish coats shall be measured as Dry Film Thickness (DFT) and comply with manufacturer's published recommendations.

2.3 Interior Paint Systems

A. Gypsum and Plaster Walls:
   1. Prime Coat: DE Ultra – Grip Acrylic Premium Primer
   2. 2nd Coat: DE Spartawall Acrylic Low VOC Eggshell Enamel
   3. 3rd Coat: DE Spartawall Acrylic Low VOC Eggshell Enamel

B. Wood Doors & Frames (Painted Finish):
   1. Prime Coat: DE Ultra-Grip Acrylic Premium Primer
   2. 2nd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel
   3. 3rd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel

C. Previously Painted Wood:
1. Prime Coat: DE Ultra-Grip Acrylic Premium Primer
2. 2nd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel
3. 3rd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel

D. Metal Doors and Frames:
1. Prime Coat: DE Ultra-Grip Acrylic Premium Primer
2. 2nd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel
3. 3rd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel

E. CMU:
1. Prime Coat: DE Ultra-Grip Acrylic Premium Primer
2. 2nd Coat: DE Spartashield 100% Acrylic Exterior Eggshell Finish
3. 3rd Coat: DE Spartashield100% Acrylic Exterior Eggshell Finish

2.4 Exterior Paint Systems

A. Interior & Exterior Surfaces of Exterior Doors:
1. Prime Coat: DE Ultra-Grip Acrylic Premium Primer
2. 2nd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel
3. 3rd Coat: DE Aristoshield Water Based Urethane Alkyd Semi-Gloss Enamel

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
a. Confirmation of primer's suitability for expected service conditions.
b. Confirmation of primer's ability to be top coated with materials specified.

D. All murals that are to remain in place, protect murals from extensive cleaning. Fully tape/mask murals during priming/painting adjacent wall surfaces.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied

protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to dull surfaces. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
   a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

4. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
   b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
   c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   d. Determine moisture content of surfaces by performing a moisture test. Do not coat if moisture content exceeds 15 percent.

5. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
   a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
      Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

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.
4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating 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.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. The number of coats and film thickness required is the same regardless of application method.
2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing, or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 10 01 10

MARKER BOARDS

PART 1 - GENERAL

1.01 WORK INCLUDED

Fixed markerboards and tackboards, frames, marker rail, trim and attachment hardware.

1.02 RELATED WORK

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.03 SUBMITTALS

A. Refer to Section 01 33 00.

B. Provide sample minimum size 12 x 18 inch, with clear anodized aluminum frame, trim, map rail and chalk-rail; in markerboard and tackboard color as selected by Architect.

C. Shop drawings: Clearly indicate board sizes and layout, method of attachment, accessories, trim profiles, details and finish. Shop drawings to include location plan showing all locations clearly indicated on floor plan of the facility. As noted on plans, replace chalkboards with markerboards, sizes as indicated on drawings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver materials to site until areas in which they are to be installed are ready to receive them

B. Deliver materials to site in protective covering in manner to protect their finishes. Store in dry and conditioned space off the floor until areas are ready for installation.

C. Spaces to be installed shall be cleaned to prevent dust and shall be conditioned spaces. Space shall be heated for a period of not less than 72 hours before the installation and shall be maintained for a minimum period of 72 hours following installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Porcelain enamel steel markerboards: Basis of Design Claridge Wall-Write Marker Wall panels.
   1. Color shall be manufacturer’s standard white.
   2. Surface shall be Glare-Free and resist crazing and scratching.
   3. Units shall be 4ft wide x 6’-8” tall. See elevations for quantity.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount prefabricated boards in accordance with manufacturer's recommendations with concealed hangers at top and bottom. Provide solid blocking in walls at all locations as required for installation. Anchor all units per CBC attachment requirements.

B. Provide flush butt hairline joints for smooth writing surface between boards sections where more than single piece surface is required. Use maximum possible lengths to minimize joints.

3.02 CLEANING

At completion of work, clean surfaces and trim, leaving ready for use.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to Work of this Section as if printed herein.

B. Section Includes: Description of requirements for materials, fabrications and installation of tackable surfaces and associated accessory items as indicated on Drawings:

1. Vinyl Tack Board Panels

2. Trim.

C. Related Work:

1. Section 07 92 00: Sealants and Caulking.

2. Section 09 29 00: Gypsum Wallboard Systems-smooth textures.

3. Section 09 91 00: Painting.

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers: The materials and systems specified herein (to establish a quality standard) are as listed under Products. Accepted equivalent products of other manufacturers may be provided.

B. Installer Qualifications: Installation shall be by manufacturer's authorized representative or a firm that is normally engaged in this business, employing skilled mechanics thoroughly trained and experienced in this type of installation and who are completely familiar with the requirements of the work specified herein.

1.03 SUBMITTALS (Submit under the provision of Section 01 33 00)

A. Manufacturer's product specifications and installation instructions for vinyl tack board panels.

B. Samples:

1. 12 inch x 12 inch swatches showing full range of colors and textures of all specified materials within 35 days after award of contract.

2. One twelve inch long sample for each type of trim molding.

3. Clear vinyl corner molding.

C. Certificates: Furnish certification that all materials conform to specification requirements.

D. Replacement Material: At completion of the work, furnish the Owner with remnants as selected. Wrap and plainly mark the color, pattern and manufacturer.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened protective packaging with manufacturer's labels indicating brand name, pattern, size and thickness; legible and intact.

B. Store materials in original protective packaging to prevent soiling, physical damage or wetting. Store sheet materials flat, on backing or supports to retain original shape, and to prevent damage to edges or corners.

C. Handle materials in such a manner as to prevent damage to products or finishes.

1.05 ENVIRONMENTAL CONDITIONS

A. Do not install specified materials until building areas are enclosed, sufficient heat is provided, dust generating activities have terminated.

B. Permit wet work to dry prior to commencement of installation.

C. Maintain a humidity of 65 to 75 percent, at a uniform temperature in the range of 65 degrees F to 70 degrees F in areas where acoustical materials are to be installed 24 hours before, during, and after installation.

D. Maintain lighting levels at 80 foot candles measured at 36 inches above floor.

E. Protect adjoining surfaces against damage and soiling.

PART 2 - PRODUCTS (See Finish Schedules for Legend Vinyl Fabric)

2.01 MATERIALS

A. Vinyl Tack Board Panels.

1. Tackboard: 4’ width x 12’ maximum length x ½” thickness conforming to:
    a. Wrapped edge treatment square
    b. Weight - .64 lbs. / sq, ft,
    c. ASTM C208
    d. Composition: Industrial insulation board machine laminated to a Type II vinyl, wrapped on all edges.
    e. Color: Shall be selected from Chatfield-Clark, Koroseal School Collection, colors.

B. Adhesive, fillers, sealers and primers shall be as recommended by manufacturer.

C. Trim: Manufacturer's standard trim where indicated.

2.02 FABRICATION

A. Bond vinyl facing material under pressure and in the factory to base board with adhesive.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect surfaces to receive tackable panels:

1. Free from dust, grease or scaly paint.

2. Free from projections or depressions that will affect smooth finish surface of tackable surface.

3. Dry and free of substance that might impair bond between base board and wall.

4. Beginning of insulation means acceptance of existing surfaces.

3.02 PREPARATION

A. Conditioning: All packages or stacks shall be opened and the vinyl tackboard placed singly around the room for a minimum of 24 hours before application.

B. Roughen slick or smooth substrate to provide a satisfactory bond.

C. Conditioning for wall covering: Condition per manufacturer recommendation.

3.03 APPLICATION

A. Adhesive: To the back side of each piece of board, apply adhesive by either of the following methods:

1. Notched Trowel - Apply adhesive in 4 inch wide ribbons along the edges and down the middle using a notched trowel with 1/4 inch deep notches spaced 1/2 inch on center.

2. Cartridge - Apply adhesive in continuous 1/4 inch to 3/8 inch beads starting at one edge of the board and spaced 16 inches on center.

B. Vinyl Tackboard Application: Place tackboard vertically against the base wall and hold a minimum of 1/2 inch off the floor. Fasten each board with 6d nails space 8 inches on center along the top and bottom of each sheet. Clean off any adhesive from vinyl surface immediately with mild soap and water.

1. At beveled edges, temporary bracing as recommended by manufacturer shall be sued to assure contact between the base wall and the tackboard until the adhesive is set (4 to 6 hours).

2. Apply tackboard prior to installation of telephone, electrical, thermostats and wall plates.

3.05 ADJUST AND CLEAN

A. Cleaning and finishing: Upon completion of work, clean all surfaces, removing any discoloration or foreign matter.

B. Defective Work: Remove and replace any defective work, such as damaged or improperly applied fabric material, which cannot be properly cleaned or reset, as directed by Architect, with no additional cost to the Owner.

C. Protect installed work from damage from other construction work.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plastic signs at building entrances, classrooms, restrooms, and as identified on drawings.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 11 00 – Metal Doors.
3. Section 08 14 00 – Wood Doors.
4. Section 09 29 00 – Gypsum Board.

1.02 REFERENCES

A. Accessible signs shall conform with the following requirements as indicated:

1. California Building Code (CBC) Title 24, 2025 Edition.
2. ADA Accessibility Guidelines (ADAAG, latest adopted edition).
3. Contracted Grade 2 Braille shall be used whenever Braille symbols are specifically required (CBC Section 11B-703.3 Braille).
4. Means of Egress Identification: CBC 11B-216.4 &11B-703.1.
5. Tactile Exit Signs: CBC 1013.4.
6. Restroom Identification Symbols: CBC 11B-216.8 &11B-703.7.2.6.
7. Signs and Identification: CBC 11B-216.1 &11B-703.1.
8. International Symbol of Accessibility: CBC 11B-703.7.2.1.
9. Direction and Information Signs: CBC 11B-703.1.
10. Symbols of Accessibility: CBC 11B-703.7.
11. Finish and Contrast: CBC 11B-703.5.1.
12. Character Proportions: CBC 11B-703.2.4.
13. Character Height: CBC 11B-703.2.5.
14. Raised Characters and Pictorial Symbol Signs: CBC 11B-703.2 & 11B-703.6.
15. Braille: CBC 11B-703.3.
16. Mounting Height and Location: CBC 11B-703.4.1 & 11B-703.4.2.
17. Symbols of Accessibility: CBC 11B-703.7.2.
18. Color of Symbol: CBC 11B-703.7.2.1.
19. Entrance Signs: CBC 11B-216.6.

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B. ASTM D4802-16(2024) - Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

C. ASTM B209-21a - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. ASTM B221-21 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM A666-24 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop drawings listing sign styles, lettering and locations and overall dimensions of each sign.

B. Two (2) samples illustrating full size sample sign with tactile characters, Braille and subsurface text or pictogram to demonstrate fabrication technique and Braille measurements which shall be used on proposed project.

C. Letters samples: 1-inch-high letters for proportions required in REGULATORY REQUIREMENTS.

D. Submit manufacturer’s technical data and installation for each type of sign required.

E. Submit samples of background colors, character colors, and one-inch high print outs of "I," "O" and "X" from proposed type styles. Indicate which type styles shall be used for required tactile characters and for required visual characters.

F. Submit proposed sign schedule to comply with scoping requirements above.

G. All signage shall be designed and constructed to comply with signage specifications and drawings.

1.04 QUALITY ASSURANCE

A. Pre-installation Meeting

1. Notify Architect when signs are ready for installation. Arrange for conference at job site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

B. Manufacturers shall submit 3 references showing products for projects completed within the last 6 years. Both tactile and non-tactile signage shall be included in the work.

C. Manufacture's Two-Year Warranties.

D. Contractor shall provide labor and materials to repair or replace defective signs as directed by Owner. Defects shall include:

1. Tactile characters and/or Braille dots which come off or are removed.
2. Discoloration, wear and scratching off of the surface color.
3 All signs and sign components, except for damage by mishandling by Owner, including installation by Owner, or vandalism.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.

1. Gravotech. www.gravotech.com
2. Or approved equal with direct compatibility with District-owned Gravotech engraving equipment and surplus engraving materials for sign types specified as "Modular".

2.02 MATERIALS

A. Modular Acrylic Framed Signs:
1. Modular sign panels mounted in permanently fixed frames with sign panels capable of being removed and replaced.
2. ADA Tactile and Braille Signs: Sand-Carved signs; thermosetting high-pressure laminate using Graphic Process Sand-Carved signs, exterior-grade, graphics, Braille and tactile copy required. Square corners, square cut edges, matt finish using **Gravotac** sheet engraving materials as manufactured by Gravotech.
   a. Frame: Single-piece, square-edge modular plastic frames with concealed screw mounting by Gravotech. Color as selected by Architect at time of submittal.
   b. ADA TactManufacturer's standard process for producing copy complying with CBC and ADA Accessibility Guidelines. Text shall be accompanied by California Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks, permanently fused to substrate.
   c. Raised-Copy Thickness: Not less than 1/32 inch.

3. Gender Neutral Restroom:
   a. Doorways leading to unisex restrooms shall be identified by circle 1/4 inch thick matte finished colored acrylic polymer material, 12 inches in diameter with 1/4-inch-thick triangle superimposed on circle and within 12-inch diameter, total 1/2 inch thick in contrasting color from door color. Sign shall be mounted in center of door 60 inches from finish floor to center of sign. Color of triangle shall have 70 percent minimum contrast with color of circle.
   b. Conform to all CBC requirement, CBC 11B.703.1 and 11B-703.7.2.6.3.

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2.03 FABRICATION

A. Regulatory Requirements

1. Tactile Character Type: Tactile characters on signs shall be raised 1/32-inch (0.794 mm) minimum, and shall be sans serif uppercase characters accompanied by Contracted (Grade 2) Braille. Helvetica Regular, uppercase letters only, refer to REGULATORY REQUIREMENTS for letter-proportion compliance. Italic, oblique script, highly decorative or unusual style forms not permitted. CBC Section 11B-703.2. Fabricate sign so that raised letter cannot be peeled off.
2. Character Proportions: Raised characters on signs shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I".
3. Tactile Character Height: Raised characters shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high. CBC Section 11B-703.2.5.
4. Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character. CBC Section 11B-703.2.6.
5. Character spacing measured between the two closest points of adjacent raised characters within a message. Where characters have rectangular cross sections, spacing shall be 1/8 inch minimum and four (4) times the stroke width, maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch minimum and four (4) times the stroke width maximum at the base of the cross sections, and 1/8 inch minimum and four (4) times the stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.
6. Line Spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
7. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background. Provide white characters on Navy Blue background to match District standard.
8. Braille: California (Contracted) Grade 2 Braille. Dot base diameter shall be 0.059 inch (1.5 mm) to 0.063 inch (1.6 mm). Dots shall be 0.100-inch (2.5 mm) on center in each cell with 0.300-inch (7.6 mm) space between corresponding dots in ad-jacent cells. Distance between corresponding dots from one cell directly below, 0.395 to 0.400 inch. Dots shall be raised 0.025 to 0.037 inch above the background. Braille dots shall be domed or rounded.
9. Polish all edges.

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PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished, in all restrooms, in center of door, or on wall adjacent to latch side as specified herein.

B. Mounting

1. Mounting Height and Location: Signs with raised characters and Braille shall be located 48 inches minimum to the baseline of the lowest line of Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surfaces. Mounting location shall be located so that a clear space of 18 inch minimum by minimum by 18 inch minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45-degree open position. CBC Section 11B-703.4.
2. Tactile Plastic Signs: Stainless steel screws (not just adhesive), pin torx, vandal-proof screw appropriate for substrate.

C. Fasteners: Stainless steel screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive.

D. Clean and polish.

3.03 FIELD QUALITY CONTROL

A. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

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END OF SECTION

REVISION SUMMARY

SECTION 10 28 00

TOILET, BATH, AND WASHROOM ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Toilet and bath, shower, and washroom accessories.
2. Framed mirror units.
3. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
4. Attachment hardware.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 REFERENCES

A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

C. ASTM A123-24 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

D. ASTM B456-17(2022) - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

E. ASTM A269-24 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00. Provide product data on accessories describing size, finish, details of function, attachment methods.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, and ADAAG or accessibility requirements.
2. Structural strength of grab bars, shower seats, fasteners and mounting devices shall conform to requirements of the CBC, California Building Code, (CCR) Title 24, Part 2, Section 11B-1009.5.7and shall withstand the application of a 250 lb. point load.

B. Coordination

1. Coordinate the work of this Section under provisions of Section 01 31 00.
2. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc., www.bobrick.com. (District standard).

B. Georgia Pacific. (District standard).

C. Hillyard. (District standard).

D. EXCEL Dryer.

E. HOSPECO.

F. Substitutions: Under provisions of Section 01 33 00.

2.02 MATERIALS

A. Sheet Steel.

B. Stainless Steel Sheet: Type 304.

C. Plastic/polycarbonate.

D. Tubing: ASTM A269-24, stainless steel, Type 304.

E. Adhesive: Two component epoxy type waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamperproof.

G. Expansion Shields: Fiber, plastic, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces from single sheet of stock, free of joints.

C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

D. Back paint components where contact is made with building finishes to prevent electrolysis.

E. Shop assemble components and package complete with anchors and fittings.

F. Provide steel anchor plates, adapters, and anchor components for installation:

G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.

H. Toilet tissue dispensers located in accessible toilet rooms or stalls shall not have their flow restricted and shall be capable of continuous flow.

2.04 FINISHES

A. Galvanizing: ASTM A123-24 to 1.25 oz/sq yd.

B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.

D. Chrome/Nickel Plating: ASTM B456-17(2022), Type SC 2 satin finish.

E. Stainless Steel: No. 4 satin luster finish.

F. Mirror Glass: FS DD-G-451 Type I, Class 1, Quality of 2, 1/4 inch thick with silver coating, copper protective coating and non-metallic paint coating complying with FS DD-M-411.

G. Stainless Steel Mirror: Type 430, 20 gage, bright annealed stainless steel.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site at appropriate time for building-in.

B. Provide templates and rough-in measurements as required.

C. Verify exact location of accessories for installation.

3.03 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Accessories required to be accessible shall be mounted at heights according to CBC Section 11B-603 and as indicated on the drawings.

D. Toilet paper dispensers and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished surface of the wall nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.

E. Contractor shall install all necessary blocking, backing, and recessed openings for all toilet accessories.

F. At locations where grab bars are mounted to toilet partition material, provide optional anchor device, Bobrick #2586 at each flange.

G. Toilet Seat Cover Dispensers: Provide at staff toilet rooms or stalls, and at gender neutral toilet rooms only. Do not provide at student toilet rooms or stalls.

H. Sanitary Napkin Disposal: Provide at staff toilet rooms or stalls, at gender neutral toilet rooms, high school girls toilet rooms, and middle school girls toilet rooms.

I. Hand Dryers: Extend power to location of hand dryer and provide necessary backbox for connection. Provide in-wall blocking for unit support.

J. Keying Accessories

1. Supply two keys for each accessory to Owner.
2. Master key all accessories.

3.04 SCHEDULE

Grab bars	Bobrick B-6808	36” and 48”
Toilet Paper Dispenser	Georgia Pacific #56784A	Surface mount, 2-roll @ accessible stalls and staff
Feminine Napkin Disposal	Hospeco 250-201W	Surface mount
Soap Dispenser	Hillyard #HIL22304	Affinity Expressions manual dispenser 1250ml. Black
Soap Dispenser Repl. Cartridge	Hillyard #HIL0039003	Affinity, Green Select Foam Soap 1250ml
Paper Towel Dispenser	Georgia Pacific #59589	Mechanical. clrm. sinks

END OF SECTION

BOBRICK

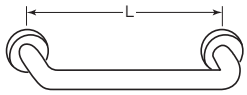
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1½" (38mm) Diameter Stainless Steel Grab Bars with Snap Flange

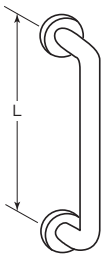
B-6806 SERIES

Specify Finish Required:
- ☐ Satin-finish, slip-resistant surface
- ☐ Peened surface; add suffix .99 to model number



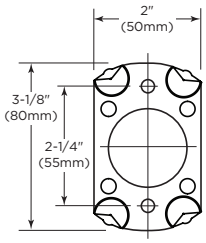


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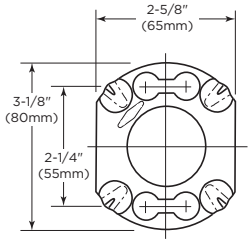


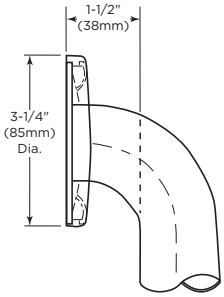
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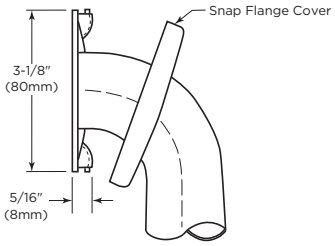
End Mounting Flange



Intermediate Flange







Standard B-6806 Series Grab Bars		
Satin Finish Model	**Peened Surface Model**	**Length**
B-6806x12	B-6806.99x12	12" (305mm)
B-6806x18	B-6806.99x18	18" (455mm)
B-6806x24	B-6806.99x24	24" (610mm)
B-6806x30	B-6806.99x30	30" (760mm)
B-6806x36	B-6806.99x36	36" (915mm)
B-6806x42	B-6806.99x42	42" (1065mm)
B-6806x48	B-6806.99x48	48" (1220mm)

ADA/ICC/CBC Installation Guidance

Horizontal Grab Bars

Recommended Mounting Heights:

*ADA/ICC/CBC: 33" min. to 36"above finished floor (AFF)

Vertical Grab Bars

Toilet Compartments Recommended Mounting Heights:

**ADA/ICC/CBC: Centerline of lower flange 39" min. to 41"above finished floor (AFF)

Shower Compartments Recommended Mounting Heights:

**ADA/ICC/CBC: Centerline of lower vertical grab bar 3" to 6" above gripping surface of horizontal grab bar. Centerline of vertical grab bar is 4" maximum from compartment entry.

*For more information regarding recommended mounting heights, please refer to Bobrick Planning Guide for Accessible Restrooms, page 21.

**For more information regarding recommended mounting heights, please refer to Bobrick Planning Guide for Accessible Restrooms, pages 21, 30, and 32.

continued . . .

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
The manufacturer reserves the right to, and does from time to time, make changes and improvements in designs and dimensions.

Revised 12/19/25 S/B

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MATERIALS:

Grab Bar — 18-8 S, type-304, 18-gauge (1.2mm) stainless steel tubing with satin-finish, slip-resistant surface. 1-1/2″ (38mm) outside diameter. Ends are heliarc welded to flanges. Clearance between the grab bar and wall is 1-1/2″ (38mm).

Concealed Mounting Flanges — 18-8 S, type-304, 11-gauge (3.2mm) thick, stainless steel plate; end flanges 2″ x 3-1/8″ (50 x 80mm) with holes for attachment to wall. Intermediate flanges 2-5/8″ x 3-1/8″ (65 x 80mm) wide x 3-1/8″ (80mm) diameter.

Snap Flange Covers — 18-8 S, type-304, 22-gauge (0.8mm) drawn stainless steel with satin-finish. 3-1/4″ (85mm) diameter x 1/2″ (13mm) deep. Each cover snaps over mounting flange to conceal mounting screws.

STRENGTH:

Bobrick grab bars that provide 1-1/2″ (38mm) clearance from wall can support loads in excess of 900 pounds (408kg) if properly installed. Other grab bar configurations can support loads in excess of 250 pounds (113kg) if properly installed, complying with accessible design (including ADAAG in the U.S.A.) for structural strength

Safety Warning: Grab bars are no stronger than the anchors and walls to which they are attached and, therefore, must be firmly secured in order to support the loads for which they are intended. To avoid potential injury, the building owner or maintenance personnel should remove the grab bar from service if the grab bar is not adequately secured to wall or if there is any observed damage to the welds.

INSTALLATION:

Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished. Fasten concealed mounting flanges to anchor device or backing with at least two screws opposing each other in each flange. Snap flange covers over each mounting flange to conceal mounting screws. Concealed anchor devices and mounting screws are not included with Bobrick grab bars and must be specified as an accessory.

For Grab Bars with an Intermediate Flange(s), Pull Snap-Flange Covers away from mounting flanges. Place grab bar in desired mounting location. Use intermediate flange as a template to mark location of mounting screws at intermediate flange only. Mark screw locations at the center of the slot in the middle of the double-keyhole shaped mounting holes (2) in the intermediate flange. Remove grab bar from wall. Drive the intermediate flange mounting screws into wall at marked locations. **Note:** Make sure to leave a space of just over 1/8″ (3.17mm) between the underside of the screw head and the wall. Install grab bar on the wall by placing the round ends of the intermediate flange double-keyhole shaped mounting holes over the mounting screws (2) are located in the middle of the flange slots. Install the mounting screws into the wall at the end flanges and secure tightly. Tighten the mounting screws at the intermediate flange. Press all snap-flange covers into place to conceal mounting flanges.

Note: Recommend use of 1/4″ or #14 sheet metal or wood screws to install Intermediate Flange. #12 screws may also be used.

Important Notes:

1. **Mounting Kits** — Bobrick offers a mounting kit for installing grab bars; **one Bobrick mounting kit is required for each flange.**

Mounting Kit No.	Description
252-30	Consists of # (3) 14 x 2½″ type-304 stainless steel, Phillips round-head, sheet-metal screws.

2. **Grab Bar Fastener** — Bobrick offers a grab bar fastening system that secures all Bobrick grab bar series; **one Bobrick fastener is required for each flange.** Install grab bar without backing in wall requires minimum 5/8″ (16mm) thick painted or tiled drywall.

WingIt™ Fastener No.	Description
251-4	Consists of 10–32 x 5/16″ round-head, Phillips 18/8 stainless steel screws. (1) WingIt grab bar fastener.

3. **Optional Anchor Device** — Bobrick grab bar anchor device includes stainless steel machine screws to be used for attaching grab bars to anchors; **one Bobrick concealed anchor device is required for each flange.**

Optional Anchor No.	Description
2583	Anchor for 3/4″ to 1″ (19-25mm) panel 1 anchor required for each flange.
2586	Anchor for 1/2″ to 1″ (13mm) panel 1 anchor required for each flange.

SPECIFICATION:

Grab bar shall be type-304 stainless steel with satin-finish, slip-resistant surface. Grab bar shall have 18-gauge (1.2mm) wall thickness and 1-1/2″ (38mm) outside diameter. Clearance between the grab bar and wall shall be 1-1/2″ (38mm). Concealed mounting flanges shall be 11-gauge (3.2mm) thick stainless steel plate, 2″ x 3-1/8″ (50 x 80mm), and equipped with at least two screw holes for attachment to wall. Flange covers shall be 22 gauge (0.8mm), 3-1/4″ (85mm) diameter x 1/2″ (13mm) deep, and shall snap over mounting flange to conceal mounting screws and/or WingIt fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar shall comply with accessible design (including ADAAG in the U.S.A.) for structural strength.

Grab Bar shall be Model _____ (insert model number) of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
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B-6806 r12/19/25 S/B
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REFERENCE GUIDE: 56783A, 56784A, 56796A, 56797A, 56798, 56784AKB, 56796AKB

Compact® Side-by-Side Tissue Dispenser

For questions regarding this dispenser or for replacement parts, please call: 1-866-HELLO GP (1-866-435-5647).

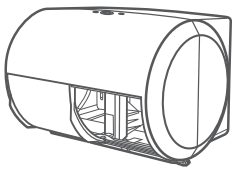
Visit gppro.com to learn more about all of our products and solutions.

Si tiene preguntas sobre este dispensador o desea adquirir piezas de repuesto, llame al número: 1-866-HELLO GP (1-866-435-5647).

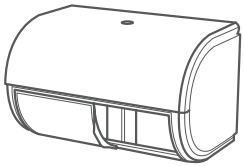
Visite el sitio web gppro.com para conocer más sobre nuestros productos y soluciones.

Pour toutes questions concernant ce distributeur ou pour des pièces de rechange, veuillez composer le 1-866-HELLO GP (1-866-435-5647).

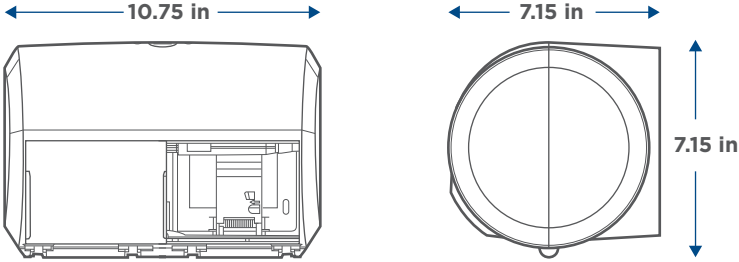
Visitez gppro.com pour en savoir plus sur l'ensemble de nos produits et de nos solutions.



56783A, 56784A, 56796A, 56797A

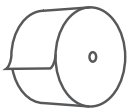


56798



Replacement Parts | Piezas de repuesto | Pièces de rechange

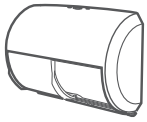
1-866-435-5647 www.gppro.com



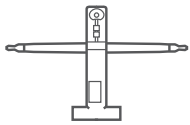
Refill
Repuesto
Recharge



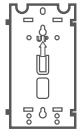
Key
Llave
Clé
SKU: 50504



Cover
Cubierta
Couvercle
BLACK SKU: 56751
WHITE SKU: 56754
GREY/BLUE SKU: 56752
FAUX SS SKU: 56753
SS SKU: ?????



Spindle Assembly
Conjunto de eje
Ensemble tige
SKU: xxxx



Mounting Bracket
Soporte de montaje
Support de montage
SKU: 54019

G-100509 REV D

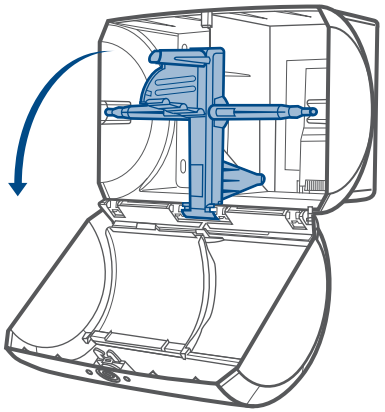
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Loading | Recarga | Chargement

A **With cover open, move spindle system downward.**

Con la cubierta abierta, tire hacia abajo el sistema de ejes.

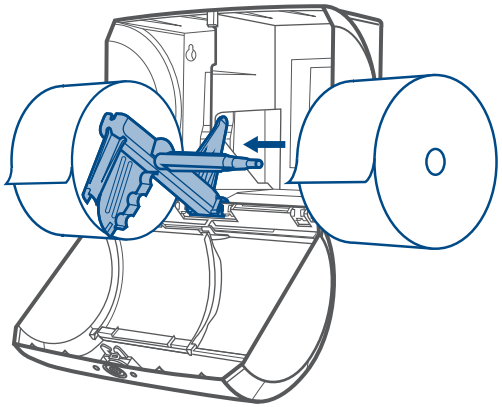
Avec le couvercle ouvert, descendez l'ensemble tige.



B **Place rolls onto spindles so tissue dispenses from top.**

Coloque los rollos en los ejes de manera que el papel se desenrolle por la parte superior del rollo.

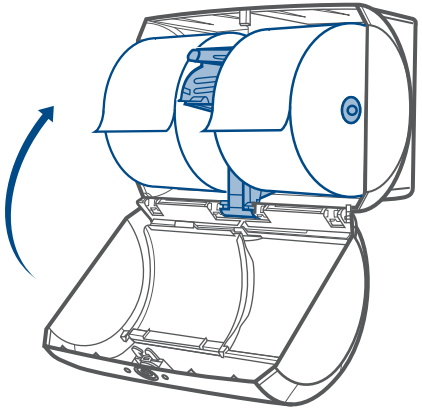
Mettez les rouleaux sur les tiges de façon à ce que le papel arrive par le dessus.



C **Close cover. The Compact® Side-by-Side Tissue Dispenser is now ready for operation.**

Cierre la cubierta. El dispensador doble de pañuelos de papel Compact® ya está listo para usar.

Fermez le couvercle. Le distributeur côte-à-côte Compact® peut maintenant être utilisé.



Direct Mount | Montaje directo | Montage direct

ADA compliant when installed according to ADA installation instructions.

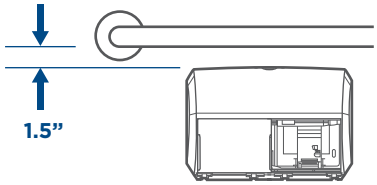
Cumple con lo establecido por la ADA (Ley de Estadounidenses con Discapacidades) si se lo instala siguiendo las instrucciones de la ADA.

Conforme aux normes de l'ADA (la loi américaine en faveur des personnes handicapées) lorsqu'installé selon les instructions de l'ADA.

1 **Position unit on wall so that the top is level. With the front cover open, mark screw locations where indicated. NOTE: Top of the dispenser should be at least 1.5" below any grab bars or other objects to ensure clearance for unlocking the unit with the key.**

Ubique la unidad sobre la pared de manera que la parte superior quede recta. Con la cubierta frontal abierta, marque las ubicaciones de los tornillos donde se indica. NOTA: La parte superior del dispensador debe estar al menos 1,5" por debajo de cualquier barra de agarre u otros objetos para asegurar que queda el espacio necesario para destrabar la unidad con la llave.

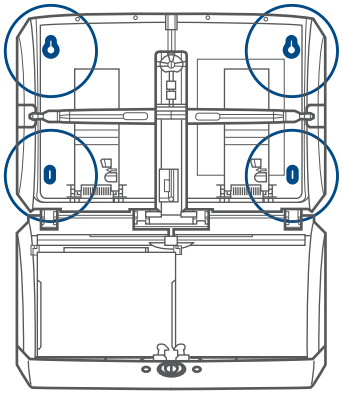
Placez l'unité au mur avec le dessus de niveau. Avec le couvercle avant ouvert, marquez les emplacements de vis comme indiqué. REMARQUE : Le dessus du distributeur devrait être à au moins 1,5" (3,75 cm) sous toute barre d'appui ou autre élément afin qu'il soit possible de le déverrouiller avec la clé.



2 **Secure unit to wall with four anchored screws in locations previously marked.**

Asegure la unidad a la pared con cuatro tornillos colocados en las ubicaciones marcadas previamente.

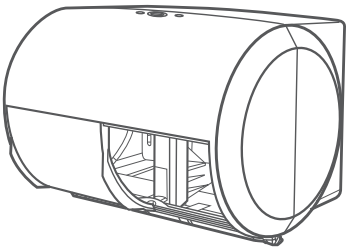
Fixez l'unité au mur avec quatre vis ancrées dans les emplacements marqués précédemment.



3 **Close Cover. Installation is complete. For instructions on how to load tissue, proceed to the last page.**

Cierre la cubierta. Terminó la instalación. Para obtener instrucciones sobre cómo colocar pañuelos de papel, consulte la última página.

Fermez le couvercle. L'installation est terminée. Pour obtenir des instructions sur la manière de charger le papier, reportez-vous à la dernière page.



Bracket Mount | Montaje del soporte | Montage sur des supports

The steps below describe using a mounting bracket (#54019 sold separately) to fasten the dispenser to a wall.

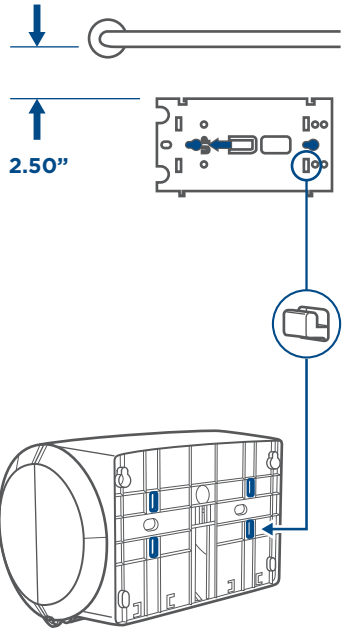
Las siguientes instrucciones describen cómo utilizar un soporte de montaje (n.º 54019 que se vende por separado) para asegurar el dispensador a la pared.

Les étapes ci-dessous décrivent l'utilisation d'un support de montage (no 54019; vendus séparément) pour fixer le distributeur au mur.

1 **Position bracket as shown with the arrow facing left. With the top level, secure bracket to wall with two anchored screws using the keyhole slots indicated. NOTE: Top of the bracket should be at least 2.50" below any grab bars or other objects to ensure clearance for unlocking the unit with the key.**

Coloque el soporte como se muestra y con la flecha señalando hacia la izquierda. Con la parte superior, asegure el soporte a la pared con dos tornillos fijados en las ranuras perforadas indicadas. NOTA: La parte superior del soporte debe estar al menos 2,50" por debajo de cualquier barra de agarre u otros objetos para asegurar que queda el espacio necesario para destrabar la unidad con la llave.

Placez le support comme montré, avec la flèche pointant vers la gauche. Avec le dessus du support de niveau, fixez le support au mur avec deux vis ancrées, dans les fentes indiquées. Remarque : Le dessus du support devrait être à au moins 2,50" (6,25 cm) sous toute barre d'appui ou autre élément afin qu'il soit possible de déverrouiller le distributeur avec la clé.



2 **Fit dispenser on bracket engaging all clips as indicated. Lock into place by gently sliding dispenser to the right until it clicks into place.**

Ajuste el dispensador sobre el soporte fijando todas las trabas como se indica. Asegure el dispensador en su lugar deslizándolo suavemente hacia la derecha hasta escuchar un "clic".

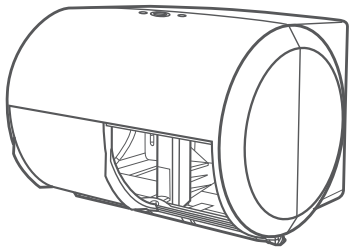
Installez le distributeur sur le support en engageant toutes les attaches, comme indiqué. Fixez-le en place en le glissant doucement vers la droite jusqu'à ce qu'il se mette en place avec un clic.



3 **Installation is complete. For instructions on how to load tissue, proceed to the last page.**

Terminó la instalación. Para obtener instrucciones sobre cómo colocar pañuelos de papel, consulte la última página.

L'installation est terminée. Pour obtenir des instructions sur la manière de charger le papier, reportez-vous à la dernière page.



Health Gards® Plastic Menstrual Care Receptacle, White, 12/cs



Maintain a cleaner, more hygienic restroom with the Health Gards® Plastic Menstrual Care Receptacle. Designed for safe and discreet disposal of feminine hygiene products, this durable unit is constructed from lightweight, stain-resistant PPC plastic for reliable performance in busy facilities. The wall-mounted design maximizes space while providing convenient access, and the hinged lid allows for controlled, odor-reducing disposal. Ideal for offices, schools, healthcare facilities, and public restrooms, this receptacle encourages proper waste disposal to help prevent plumbing problems caused by flushing. A practical addition to any complete menstrual care solution, it supports cleanliness, efficiency, and user comfort.

Key Features

- Waste receptacles provide hygienic feminine napkin disposal in the restroom
- Helps prevent plumbing problems by encouraging proper disposal and discouraging flushing of waste
- Surface mount bracket included
- Made from PPC, it is lightweight, durable and resists staining

SKU	250-201W
Brand	Hospeco®
Sub-Brand	Health Gards®
Case LxWxH	0 x 0 x 0
Case Weight (lbs.)	0
Color	White
Country of Origin	United States
Cube	0.37
HTS CODE	3924.90.00.99
Inner Carton Height (in)	5.7
Inner Carton Length (in)	9.4
Inner Carton Weight (lb)	0.85
Inner Carton Width (in)	11.8
Material	Polypropylene Copolymer
NMFC	156600S3
Packaging Put/Up	1/ea - 12 ea/cs
Pallet Ti x Hi x Qty	48 x 4 x 192
Product Height (inches)	11
Product Length (inches)	8
Product Width (inches)	4.25
Sell UOM LxWxH	EA - 11.8 x 9.4 x 5.7
Size	8.75 in x 4.875 in x 10.5 in
UPC	075289015991
GTIN ITF-14 Case	10075289015998

affinity™

by HILLYARD



An Innovatively Simple Skin Care System

HILLYARD®

The Cleaning Resource®

Innovatively Simple

One reliable, robust system delivering foam, liquid or gel. It's your choice. Fresh new fragrances and bright attractive colors that will appeal to your senses. Add our Green Seal™ certified formulas and you have Affinity by Hillyard, the innovatively simple skin care system.

affinity™
by HILLYARD



af•fin•i•ty: a natural liking for or attraction to

Next Generation Skin Care Technology Available Today

Designed by Hillyard, the company delivering innovative cleaning and hygiene solutions for over 100 years. Our rich heritage includes designing systems dedicated to advancing the health and well-being of our customers. So much so, that our founder, Newton Hillyard, was awarded patents in the early 1930's for innovatively designed hand soap systems.* It's Mr. Hillyard's spirit of innovation that continues on today with Affinity by Hillyard.



One System

Foam Liquid Gel Spray



** U.S. Patents 1939980 issued 1933, 1945111 and 1947086 issued in 1934.*

Sustainably Engineered

- Space-saving dispenser design utilizes 25% less plastic by weight than other 1,250* mL dispensers without compromising reliability or durability.

- Crystal clear, easily recyclable, super thin, yet super strong bi-directionally molded PET bottles and thoughtfully designed pumps utilize up to 50% less plastic than other 1,250* mL refills.





affinity™ by HILLYARD

*Touch-free refills are 1,000 mL.

Unrelenting Quality
Tested for Trouble-free Performance



Every part of our system is thoroughly tested. Formulas, pumps, bottles and dispensers. On-staff microbiologists constantly monitor quality while components are rigorously tested.

The pump is one of the most critical components of any soap system. It must be durable to withstand thousands of activations, yet simple enough to be part of a cost-effective, sealed, and disposable refill. The Affinity pump strikes the perfect balance.

EVERY Affinity pump goes through a series of automated tests. After a pump passes ALL of its tests, the data is recorded and a unique id number is stamped on its side.

Many pumps might be designed for trouble-free performance. Affinity pumps are designed AND tested for trouble-free performance. Every single one of them!

Sustainable Formulation

USDA CERTIFIED BIOBASED PRODUCT

USDA Certified Biobased Product - Only by choosing biobased products labeled "USDA Certified Biobased Products" can the consumer be assured that the USDA and the Federal government stand behind the accuracy of the claim that the product contains biological ingredients in the amounts stated on the label. Manufacturers and vendors who have obtained the rights to use the BioPreferred label on a product have submitted to USDA test evidence of the biobased content of the product or package.

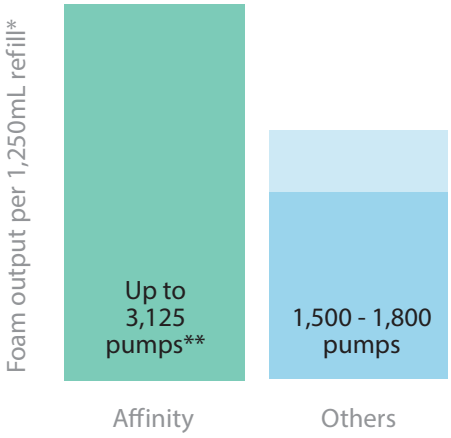
GREEN SEAL

Green Seal® - Green Seal develops life cycle-based sustainability standards for products, services and companies and offer third-party certification for those that meet the criteria in the standard. Green Seal has been actively identifying and promoting sustainability in the marketplace, and helping organizations be greener in a real and effective way since 1989. www.greenseal.org

See the last page for a complete list of formulas designated as Green Seal Certified and USDA Biobased Certified.

Facility Friendly

- High-capacity refills last longer and require fewer changes.
- Fully ADA compliant, Affinity dispensers measure less than 4" deep and operate with less than 5 pounds of force.
- The large sight window makes it easy for staff to monitor refills.
- Sealed, hygienic refills reduce the risk of contamination associated with bulk soap dispensers.
- The Affinity manual dispenser can be set up as either push button access or key access for additional security.
- A thoughtful backplate design covers most dispenser footprints eliminating extra wall plates or time-consuming wall repairs.





affinity™ by HILLYARD

Scan the QR Code to view more information, videos and downloads for Affinity!

*Based on Affinity Manual System.
**Based on 0.4 mL per press.

A Cost Effective Combination Designed for Financially Savvy Managers

It's a pretty simple concept. Design a high-quality system that performs well under the pressure of facility budgets. Take the view that building long-term relationships with customers outweighs the quick sale. And, the result is Affinity by Hillyard.

- Thick, rich formulas enriched with moisturizers and natural conditioners.
- Efficient pump system delivers the right amount of product minimizing waste. Foam output is 0.6 mL. Manual dispensers can restrict foam output to 0.4 mL. Gel and liquid output is 1.0 mL.
- One dispensing system with your choice of refills simplifies purchasing and makes it easy to train staff.



Helping Build Hygiene Awareness

Go to hillyard.com to download professionally designed posters to build hygiene awareness!

Posters are available for schools, offices, health care facilities, fitness centers, food service establishments and more!



Go Manual or Touchless

It's Your Choice!

affinity Expressions





Includes 4-C Batteries

Modular Design

Designed for trouble-free performance. In the unlikely event the drive mechanism stops working, it can easily be replaced without taking the dispenser off the wall.



Easily replace existing dispensers. The backplate has been designed to match many mounting configurations.

Our Pledge

With over 100 years of experience, we stand behind our products. If you are not completely satisfied with Affinity, return the dispenser and unused refills for a full refund.

affinity Expressions

Custom Dispenser Plates





BUILDING YOUR BRAND IT'S AS EASY AS 1-2-3

- Full color printing, low minimums - 18 plates.
- Branding plates are adhesive-backed and can easily be installed on wall-mounted dispensers.
- Choice of solid or window-cut plates, black or white
- Designs only limited by your creativity.
- Self-service design and ordering portal, just upload and order.

Go to artwork.hillyard.com to order branding plates.



HILLYARD
The Cleaning Resource®

affinity by HILLYARD

Refills

System Specifications

foam

Description	Color	GREEN SEAL		Touch-Free System Item No.	Touch-Free System Case Pack	Manual System Item No.	Manual System Case Pack
Mandarin-Cranberry Premium Foam Soap	Sunset Orange	✓	83%	HIL0039402	3-1,000mL	HIL0039403	4-1,250mL
Cucumber-Melon Premium Foam Soap	Melon Green	✓	81%	HIL0039802	3-1,000mL	HIL0039803	4-1,250mL
Green Select® Foaming Hand Soap	Crystal Clear	✓	86%	HIL0039002	3-1,000mL	HIL0039003	4-1,250mL
Green Premium Foaming Hand Soap	Crystal Clear	✓	85%	HIL0041102	3-1,000mL	HIL0041103	4-1,250mL
Citrus Fresh Antimicrobial Foaming Hand Soap (Active: PCMX)	Sienna Orange	x	-	HIL0040802	3-1,000mL	HIL0040803	4-1,250mL
E2 Food Industry Foam Soap (Active: Benzalkonium Chloride)*	Crystal Clear	x	-	HIL0041902	3-1,000mL	HIL0041903	4-1,250mL
Foaming Hair and Body Wash	Emerald Green	x	71%	-	-	HIL0039103	4-1,250mL
Foaming Instant Hand Sanitizer	Crystal Clear	x	98%	HIL0041003	4-1,000mL	HIL0041003	4-1,000mL
Alcohol Free Foaming Instant Hand Sanitizer	Crystal Clear	x	-	HIL0040302	3-1,000mL	HIL0040303	4-1,250mL

liquid

Description	Color	GREEN SEAL		Item No.	Case Pack	Manual System Item No.	Manual System Case Pack
Pink Lotion Hand Soap	Pink	x	-	-	-	HIL0040403	4-1,250mL

gel

Description	Color	GREEN SEAL		Item No.	Case Pack	Manual System Item No.	Manual System Case Pack
Instant Hand Sanitizer Gel	Crystal Clear	x	98%	-	-	HIL0040203	4-1,000mL
Hair & Body Wash Gel	Emerald Green	x	84%	-	-	HIL0036403	4-1,250mL

spray

Description	Color	GREEN SEAL		Item No.	Case Pack
Alcohol-based Instant Hand Sanitizer Spray - 70% Alcohol	Crystal Clear	x	98%	HIL0042203	4-1,000mL

*NSF Certified E2 for use as a hand washing and sanitizing compound for use in and around food processing areas.

Touch-free Dispensers



White Dispenser
HIL22410



Black Dispenser
HIL22411

Dimensions	10.5"T x 6.5"W x 3.75"D
Foam Output	0.6 mL per press
Liquid Output	1.0 mL per press
Gel Output	1.0 mL per press
Case Pack	1
Refill Size / Pack	3 - 1,000 mL cartridges

Manual Dispensers



White Dispenser
HIL22303



Black Dispenser
HIL22304

Dimensions	11.0"T x 6.25"W x 3.75"D
Foam Output	0.4/0.6 mL per press
Liquid Output	1.0 mL per press
Gel Output	1.0 mL per press
Case Pack	6
Refill Size / Pack	4 - 1,250 mL cartridges*

Accessories



Clean Tray
HIL22075
Color: Graphite
Case Pack: 12



Floor Stand
HIL22278
Color: Gray

* Instant Hand Sanitizer case pack is 4 - 1,000 mL cartridges.

Subject to change without notice.

HILLYARD
The Cleaning Resource®

PACIFIC BLUE ULTRA® 8" HIGH-CAPACITY MECHANICAL TOUCHLESS PAPER TOWEL DISPENSER BY GP PRO (GEORGIA-PACIFIC), BLACK, 1 DISPENSER

Description:

From the innovators at GP PRO comes the Pacific Blue Ultra® mechanical towel dispenser. Attractive, contemporary and affordable, this one-at-a-time manual paper towel dispenser combines the efficiency you expect from GP PRO with the durability you need for day-to-day performance. This high-capacity commercial paper towel dispenser helps avoid run out situations and extends maintenance intervals, helping to reduce maintenance time and costs. Pacific Blue Ultra® High Capacity Mechanical Touchless Paper Towel Dispenser works exclusively with Pacific Blue Ultra® High-Capacity towel rolls (26490, 26491, 26495, 26596). Pair with other Pacific Blue Ultra® dispensers for an affordable, efficient restroom solution that enhances the professional, coordinated look in your facilities.

Features and Benefits:

- AFFORDABLE QUALITY commercial paper towel dispenser is a budget-friendly choice with one-at-a-time dispensing
- DURABLE MANUAL PAPER TOWEL DISPENSER is sold, not leased; built to handle heavy usage & requires no batteries, backed by a 10-year warranty
- HIGH-CAPACITY DESIGN holds 1150-ft towel rolls that last longer, helping minimize refilling
- HYGIENIC no-touch hang mode helps reduce cross contamination
- COMPATIBLE WITH Pacific Blue Ultra® Roll Paper Towels 26490, 26491, 26495, 26496
- WASTE-SAVING DESIGN uses stub roll towels to ensure that nearly the entire roll is used up
- LOWER COST per hand dry—can reduce paper towel usage by up to 25% as compared to standard multifold towels (GP PRO Proprietary Research: CPT-21-5178)
- REPLACEABLE CHASSIS prevents the need for an entire new dispenser in the event of a failure
- EASY TO REFILL wall mounted paper towel dispenser designed with easy-access front cover that opens 180°
- EASY TO REFILL wall mounted paper towel dispenser designed with easy-access front cover that opens 180°
- FLEXIBLE REFILL OPTIONS Choose between white or brown paper towels and 3-Roll or 6-Roll cases
- IDEAL for food service, industrial facilities, schools, government buildings and smaller office buildings; great for restrooms, breakrooms and more
- ENHANCED IMAGE with attractive black paper towel dispenser design that coordinates with Pacific Blue® skincare and tissue dispensers



PRODUCT DETAILS	
Brand Owner	GEORGIA-PACIFIC
Brand	PACIFIC BLUE ULTRA
MFG #	59589
Color	BLACK
UP-UPC	073310595894
UNSPSC	47131701
Size LxWxH	9.000" x 12.900" x 16.000"
Kosher	NO
Economic Order Quantity	1.000 EA
LeedOM	

CASE SHIPPING INFO	
Case GTIN	10073310595891
Case Gross Weight	8
Case Net Weight	6.75
Case Dimensions LxWxH	9.000" x 12.900" x 16.000"
Case Volume	1.075 CFT
Case Total	1 DISPENSER

EACH SHIPPING INFO	
Each Gross Weight	8.000 LB
Each Net Wgt	6.750 LB
Each Dimensions LxWxH	9.000" x 12.900" x 16.000"
Each Volume	1.075 CFT
Items Per Each	1 DISPENSER

UNIT SHIPPING INFO	
TI-QTY/Layer	8
HI-Layers/Unit	10
Unit Qty	80
Unit Dimensions LxWxH	46.625" x 40.500" x 100.000"
Shipping Container Type	53Ft Trk Floor Ship
Truck Load Qty (Floor)	30

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SECTION 22 00 50

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric motors.
2. Motor starters.
3. Strainers.
4. Valve boxes.
5. Gauges.
6. Thermometers.
7. Access Doors.
8. Expansion loops.
9. Flexible joints.
10. Insulation.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section is a part of each Division 22 Section.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.

C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.04 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. CSA – Canadian Standards Association International.
2. ANSI - American National Standards Institute.
3. ASTM - American Society for Testing and Materials.
4. CCR - California Code of Regulations.

a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.
6. CEC - California Electrical Code.
7. NEMA - National Electrical Manufacturers' Association.
8. NFPA - National Fire Protection Association.
9. OSHA - Occupational Safety and Health Act.
10. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

a. California Building Code, 2025.
b. California Electrical Code, 2025.
c. California Energy Code, 2025.
d. California Fire Code, 2025.
e. California Green Building Standards Code, 2025.
f. California Mechanical Code, 2025.
g. California Plumbing Code, 2025.
h. California Code of Regulations, Title 24.
i. California Health and Safety Code.
j. CAL-OSHA.
k. California State Fire Marshal, Title 19 CCR.
l. National Fire Protection Association.
m. Occupational Safety and Health Administration.
n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.05 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange

Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 FEES AND PERMITS

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

C. Prior to the start of construction, contact local gas company representative and coordinate location of gas meter and piping. In addition, coordinate time required for installation, in order to avoid delay to the Project.

D. Coordination:

1. General:

a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate

120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.

3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

   a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
   b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
   c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”
   d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.07 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

   1. Partial or incomplete submittals will not be considered.
   2. Quantities are Contractor's responsibility and will not be reviewed.
   3. Provide materials of the same brand or manufacturer for each class of equipment or material.
   4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
   5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
   6. Organize submittals in same sequence as in Specification Sections.
   7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

      a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
      b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.

c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.08 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.09 INFORMATIONAL SUBMITTALS

A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.
2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
6) Copies of guarantees/warrantees for each item of equipment and systems.
7) Test data and system balancing reports.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) Control diagrams and literature.
11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
13) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.

1) RFI, ASI, CCD references pasted onto contract documents or final shop drawings by the Contractor, or provided as reference, does not suffice as record of the as-built conditions. The Contractor shall document the as-built conditions showing Work exactly as installed using red-lined markups of the contract documents or final shop drawings.

b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor’s signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see “Submittals.”
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is the Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.

C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.

E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with the warranty requirements within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS AND PRODUCTS

A. No material installed as part of this Work shall contain asbestos.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.03 STRAINERS FOR POTABLE WATER SYSTEMS

A. Strainers: Full line size, conforming to lead-free requirements of California Health and safety Code Section 11 68 75. "Y" pattern, 125 psi SWP minimum, with 304 stainless steel screens. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 3 inches and smaller: bronze or brass body, threaded ends, with 20 mesh screen. Watts LF777SI, Wilkins SXL.
b. 4 inches and larger: Cast iron body, flanged ends, 1/16 inch or 1/8 inch screen as normally supplied for each size. Watts 77F-DI-125, Mueller 758.

2.04 STRAINERS FOR NON-POTABLE WATER SYSTEMS

A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.05 VALVE BOXES

A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular “vault” type adequately sized for condition and similar in construction to those specified above.
2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.06 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated” where required.

2.07 EQUIPMENT IDENTIFICATION

A. Refer to Section 22 05 53 – Plumbing Identification.

2.08 PIPE IDENTIFICATION

A. Refer to Section 22 05 53 – Plumbing Identification.

2.09 INSULATION WORK

A. General:

1. For insulating domestic hot water pumps, refer to Section 22 50 00, Plumbing Equipment,

2. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
3. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
4. The term "piping" used herein includes pipe, valves, strainers and fittings.
5. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
6. Provide pre-formed PVC valve and fitting covers.
7. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
8. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
9. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
10. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:

    a. Pipe 3/4 inches and smaller: 1 inch thick.
    b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.
    c. Pipe 2 inches and larger: 2 inches thick.

2. Insulate domestic hot water piping under slab on grade with Owens Corning Foamglas, preformed pipe insulation, or equal. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Cover pipe and fittings with insulation manufacturer’s recommended jacketing. Insulation thickness shall be the following:

    a. Pipe 3/4 inches and smaller: 2 inches thick.
    b. Pipe 1 inch and larger: 3 inches thick.

3. Insulate domestic cold water piping located within building, outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
4. Insulate domestic cold water piping located outside building exposed to weather with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness for all pipe sizes: 2 inches.
5. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.

6. Insulate condensate drain piping in freezer with 3/4 inch thick Therma-Cel, Armaflex, or equal. Seal water tight per manufacturer's directions. Install heat tape prior to insulation of piping, in accordance with manufacturer's directions.
7. Insulate electrically heat-traced grease waste piping under slab on grade with Owens Corning Foamglas, preformed pipe insulation, or equal. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Cover pipe and fittings with insulation manufacturer's recommended jacketing. Insulation thickness for all pipe sizes: 3 inches.
8. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor's option.
9. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

    a. Fitting covers:

        1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        2) Tee covers.
        3) Flange and union covers.
        4) End caps.
        5) Beveled collars.
        6) Valve covers.
        7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

    b. Jacket thickness:

        1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
        2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.01 EXISTING MATERIALS

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.02 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.03 PLUMBING DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.04 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.05 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.06 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

a. Black Steel Piping:

1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.07 EXCAVATING

A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

C. Maintain all warning signs, barricades, flares, and red lanterns as required.

D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.08 BACKFILLING

A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.

B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.

1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.

C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.09 PIPING SYSTEMS INSTALLATION

A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.
15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping

connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.

16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

    a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Systems to be installed in strict accordance with manufacturer's instructions.

6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

G. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

   a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
   b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.

2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.

H. Hangers and Supports:

1. Refer to Section 22 05 29 – Plumbing Pipe Support and Anchors.

3.10 UNION AND FLANGE INSTALLATION

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

B. Install unions in piping NPS 2” and smaller, and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.13 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.

a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.

2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Sleeve copper piping/tubing installed below slab with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils

thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer's recommendations and instructions.

F. Sleeve copper piping/tubing installed outside building below grade with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer's recommendations and instructions.

G. Sleeve cast iron and ductile iron pipe below grade and below slab with "Polywrap" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer's recommendations and instructions.

H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.14 PIPE IDENTIFICATION

A. Refer to Section 22 05 53 – Plumbing Identification.

3.15 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.16 PIPING SYSTEM PRESSURE TESTING

A. General:

1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:

1. Authority having jurisdiction shall witness tests of piping systems.
2. Notify Architect at least seven days in advance of testing.
3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
5. Isolate from system equipment that may be damaged by test pressure.
6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.

    a. Authority having jurisdiction shall witness final connection to system.

C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

1. Flush deionized water lines with deionized water after test and approval.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.17 TRACER WIRES

A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #14 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.18 OPERATION OF SYSTEMS

A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.19 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner’s representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.20 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. Specified filters are installed and spare filters have been turned over to Owner.
4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
5. All equipment has been cleaned, and damaged painted finishes touched up.
6. Missing or damaged parts have been replaced.
7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
10. Preliminary test and balance work is complete, and reports have been forwarded for review.
11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

D. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

E. Preliminary Operation:

1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.21 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable “Certificates of Installation” forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.22 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner’s representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 09 90 00 - Paints and Coatings: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

A. See Section 00 72 00 - Submittals, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: Equipment, control panels 1 inch.

3. Letter Height: Thermostats and small control components, 1/4 inch.

4. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Access Doors and Similar Operational Instructions: Minimum 3/4" high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

D. Service Markers: Identify buried plugged or capped pipe with concrete marker, 4 inch diameter by 30 inches long, set flush with grade. Provide engraved brass nameplate identifying pipe stub.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify domestic hot water heating equipment, including water heaters, pumps, expansion tanks, etc. with plastic nameplates.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Tag automatic controls, instruments, and relays. Key to control schematic.

J. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Provide red ceiling dots to locate valves above T-bar type panel ceilings. Locate in corner of T-bar panel closest to equipment.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe and fittings.

2. Valves.

3. Domestic water piping specialties.

4. Gas piping specialties.

5. Drain and waste piping specialties.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.04 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Provide welding certificate for all gas pipe welders.

C. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.05 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.07 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be qualified by the gas utility supplying Project site. The qualifications shall be current at the time of performing the Work.

C. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."

D. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

E. Fabricate and install natural gas systems in accordance with California Plumbing Code.

F. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.02 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.

B. Drain and Waste Pipe Above Grade: Solvent weld PVC DWV pipe with belled end, and fittings, conforming to ASTM D2729 and so marked. Where installed exposed in ducts or plenums PVC pipe and fittings shall have a flame/smoke spread rating of not more than 25/50 in accordance with ASTM E84 or UL 723. Pipe and fittings shall be as manufactured by Charlotte, Westlake, or equal. Pipe and fittings shall be the products of a single manufacturer. Or, cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor’s option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.

1. Cast iron joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more.

Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).

C. Drain and Waste Pipe Below Grade: Solvent weld PVC DWV pipe with belled end, and fittings, conforming to ASTM D2729 and so marked. Pipe and fittings shall be as manufactured by Charlotte, Westlake, or equal. Pipe and fittings shall be the products of a single manufacturer. Or, cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Cast iron joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.

2. Cast iron joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.

D. Vent Pipe:

1. 3 inch and larger, above grade: Solvent weld PVC DWV pipe with belled end, and fittings, conforming to ASTM D2729 and so marked. Where installed exposed in ducts or plenums PVC pipe and fittings shall have a flame/smoke spread rating of not more than 25/50 in accordance with ASTM E84 or UL 723. Pipe and fittings shall be as manufactured by Charlotte, Westlake, or equal. Pipe and fittings shall be the products of a single manufacturer. Or, cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.

2. 2-1/2 inch and smaller, above grade: Solvent weld PVC DWV pipe and fittings as specified for sizes 3" and larger. Or, cast iron soil pipe and fittings as specified for sizes 3 inch and larger, Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.

3. Vent pipe below grade and to 6 inches above grade: Solvent weld PVC DWV pipe with belled end, and fittings, conforming to ASTM D2729 and so marked. Pipe and fittings shall be as manufactured by Charlotte, Westlake, or equal. Pipe and fittings shall be the products of a single manufacturer. Or, cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.

E. Type DWV copper tubing or No-Hub cast iron pipe and fittings may be used for concealed rainwater leaders. Where no-hub piping is used, the fittings and couplings shall match those used for waste piping.

F. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.

G. Condensate Drain Piping:

1. Inside buildings provide ASTM B88, Type M copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.

2. Outside buildings provide Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.

3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.

4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal connector at mechanical equipment, Metraflex Model SST, or equal by Unisource Mfg. Co., or Flexicraft Industries. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.

5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.

6. Provide cleanout tees or “Y” at each change in direction.

H. Condensing-Type Equipment Condensate Drain Pipe: CPVC pipe and fittings conforming to ASTM D-2846.

1. Provide CPVC condensate drain pipe for condensing water heaters, furnaces, and where shown on Drawings.

2. Piping and fittings shall be as manufactured by Spears Manufacturing, Charlotte Pipe and foundry Co., or equal.

2.03 PIPE JOINING MATERIALS

A. Refer to piping Articles in this Section for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated

a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.

3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.

4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

E. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 11 68 75.

a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.

1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 11 68 75.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.

2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.

3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.

4. Main distribution gate valves underground outside building above 1-1/2 inches:

a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.

1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.

2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:

1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.

2. Provide valves with the following:

a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.

b. Bodies: ductile iron or cast iron.

c. Discs: Bronze or stainless steel.

d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.

e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.

a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.

b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrinding, Mueller 103MAP, or equal.

2.05 DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and whenever sanitary sewer exits building. All two-way cleanouts shall have (2) risers, each in opposing directions.

    a. Provide cleanouts in waste drop from each sink and urinal.

    b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.

2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.

3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).

4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.

5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.

    a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.

    b. Install face of cleanout plug within 1/2 inch of front face of finished wall.

6. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18 by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.

7. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.

8. Cleanouts in acid waste systems: Zurn ZN-1404, or equal, cleanout access housing, with ductile cast iron body and nickel bronze top. Extend acid waste piping within the cleanout, and terminate with threaded cap. Secure acid waste pipe inside cleanout access housing with setscrews provided.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.

C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.

D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.02 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.

1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.

2. Install water hammer arresters above accessible ceilings, or install access doors for service.

C. In freezing locations arrange water piping to drain as shown.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.

3.03 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.

B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.

C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

E. Install rainwater leader nozzles at exposed bottom of leaders where they spill onto grade.

F. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

G. Grade all vent piping so as to free itself quickly of any water condensation.

H. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.

I. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.

J. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

K. PVC DWV pipe and fittings shall be installed in accordance with ASTM D2321 and ASTM F1668.

L. Auger out all new gravity piping systems all the way out to the first manhole. Also applies to connection of new gravity piping systems to existing site utilities. Contractor to provide camera service and deliver to district video evidence of all new gravity piping systems being free and clear of any debris and/or obstructions.

3.04 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.

3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: 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 ID. Join pipe fittings and valves as follows:

1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Piping: Join according to ASTM D 2855.

E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.

1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.

F. Cast Iron Soil Pipe:

1. No-Hub fittings shall be made with a torque wrench.

2. Hub joints shall be with Ty-Seal couplings.

3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.

4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

G. Welded Pipe:

1. Make up with oxyacetylene or electric arc process.

2. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.

3. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.

H. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer's instructions.

I. Polyethylene and Polypropylene Pipe: Assemble with fusion joints in strict accordance with manufacturer's instructions.

J. Make joints in PVC water pipe with PVC couplings and rubber rings, Manville Ring-Tite, PW Pipe, or equal. Check final location of rubber rings with the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron or PVC adapter fittings, installed as recommended by the manufacturer. Ring-Tite PVC or cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the water pipe with PVC couplings.

K. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.

2. Anchor piping securely on the system side of each flexible connection.

3.05 INSTALLATION OF VALVES

A. Install valves as indicated on Drawings and in the following locations:

1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.

3. Provide gate or globe valves on inlet and outlet of each water heater or pump.

B. General:

1. Valves shall be full line size unless indicated otherwise on Drawings.

2. Install horizontal valves with valve stem above horizontal, except butterfly valves.

3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

4. Locate valves for easy access and provide separate support where necessary.

5. Install valves in position to allow full stem movement.

6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.

7. Butterfly valves conforming to the paragraph “Butterfly Valves” may be used in lieu of gate or globe valves for locations above grade.

8. Ball valves conforming to the paragraph “Ball Valves” may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.

9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.

10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.

C. Gate Valves:

1. Furnish valves in copper lines with adapters to suit valve / line requirements.

2. Underground gate valves:

a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

D. Swing Check Valves: Install in horizontal position with hinge pin level.

E. Butterfly Valves: Install with stems horizontal.

F. Silent Check Valves: Install in horizontal or vertical position between flanges.

G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers’ recommendations, including requirements for straight pipe lengths at valve inlet and outlet.

H. Gas Shut-Off Valves:

1. Provide line size ball valve in gas line to each appliance.

2. Provide line size ball valve in gas line, to be used as emergency shut-off for science classrooms. Install valve in locking box where indicated on the drawings.

3. Provide line size electric solenoid gas valve in gas line to kitchen equipment (if not supplied with appliance) under Type 1 hood. Interlock with hood fire alarm system.

I. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.06 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.07 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.

B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.08 INSTALLATION OF ROOF DRAINS AND OVERFLOW DRAINS

A. Install roof drains and overflow roof drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

3.09 INSTALLATION OF HOPPER DRAINS

A. Install hopper drain in wall, in sheet metal box, with access door.

1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.

B. Grind top and sides of funnel, if required, to suit wall thickness.

3.10 DOMESTIC WATER SYSTEM STERILIZATION

A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.

1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.11 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment,

fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.12 OPERATIONAL TESTS

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.13 TESTING AND BALANCING

A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.14 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Water supplies and stops.

2. Plumbing fixture hangers and supports.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.03 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.04 INFORMATIONAL SUBMITTALS

A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.05 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.06 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:

1. 2025 California Building Code – CBC

2. 2025 California Plumbing Code – CPC

3. 2025 California Health and Safety Code

4. American National Standards Institute - ANSI

5. Federal Standards - F.S.

6. National Sanitary Foundation – NSF International

C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”

D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.

F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.

G. Americans with Disabilities Act (ADA).

H. California Green Building Standards Code Requirements:

1. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets.

2. Single Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Showerheads.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.

1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.

2. Take location and mounting heights for roughing-in from Architectural Drawings.

3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.

4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.02 MATERIALS

A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.

C. Handles on all faucets and stops shall be all metal chromium plated.

D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.

1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.

C. Carriers: Provide cast iron wall mounted supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.

F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.

G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.04 MANUFACTURERS

A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.

B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:

1. Plumbing Trim:

    a. McGuire Manufacturing Co., Inc.

    b. Delta Commercial.

    c. Chicago Faucet Co.

    d. T&S Brass and Bronze Works, Inc.

2. Faucets:

    a. Chicago Faucet Co.

    b. T&S Brass and Bronze Works, Inc.

    c. Delta Commercial.

3. Stainless Steel Sinks:

    a. Elkay Mfg. Co.

    b. Just Mfg. Co.

    c. Haws Corporation.

2.05 FIXTURE CONNECTIONS

A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Dearborn Brass, Commercial series with brass nuts.

    b. Delta Commercial.

    c. McGuire Manufacturing Co., Inc.

C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.

D. Plumbing fixture traps connected to special waste systems shall be constructed of materials to suit the waste system.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Orion.

    b. Enfield

E. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.06 WATER SUPPLIES AND STOPS

A. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.

B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.

C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.

D. Provide cast brass escutcheon.

E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. McGuire Manufacturing Company, Inc., model LFH2167LK.

2. T & S Brass and Bronze Works, Inc., model B-1305.

2.07 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Floor-affixed supports for off-the-floor plumbing fixtures shall comply with ASME A112.6.1M.

B. Residential type fixture supports are not acceptable.

C. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.

D. Install the following fixtures on wall mounted concealed arm support carrier securely anchored to wall.

1. Wall hung lavatories.

2. Drinking fountains.

2.08 PLUMBING FIXTURES

A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.

B. Special Requirements For Accessible Fixtures:

1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.

2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded “closed-cell” vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.02 PREPARATORY PROVISIONS

A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.03 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.

3.04 FAUCET INSTALLATION

A. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.

B. Adjust metering faucets to run for 10 to 15 seconds.

3.05 CLEAN AND PROTECT

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.06 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.07 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units installed.

B. Flush Valve Diaphragms: Furnish one diaphragm for every three units installed.

C. Faucet Cartridges: Furnish minimum four sets per project, or one set per five units installed, whichever is greater.

END OF SECTION

SECTION 23 00 50

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric motors.
2. Motor starters.
3. Strainers.
4. Gauges.
5. Thermometers.
6. Access Doors.
7. Flexible joints.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section is a part of each Division 23 Section.

C. Refer to Section 23 08 00. T-24 Commissioning of HVAC for Title 24 commissioning and acceptance testing requirements.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.

C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.04 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.

a. Standard 210 - Laboratory Methods of Testing Fans

4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations

    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36

10. CSA – Canadian Standards Association International
11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

    a. California Building Code, 2025.
    b. California Electrical Code, 2025.
    c. California Energy Code, 2025.
    d. California Fire Code, 2025.
    e. California Green Building Standards Code, 2025.
    f. California Mechanical Code, 2025.
    g. California Plumbing Code, 2025.
    h. California Code of Regulations, Title 24.
    i. California Health and Safety Code.
    j. CAL-OSHA.
    k. California State Fire Marshal, Title 19 CCR.
    l. National Fire Protection Association.
    m. Occupational Safety and Health Administration.
    n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.05 DRAWINGS

A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Coordination:

1. General:

a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.
3. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.

2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

4. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”
d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.07 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of the same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.

b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.08 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.09 INFORMATIONAL SUBMITTALS

A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.

B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.

C. Check, Test, and Start forms, from equipment manufacturers.

D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
6) Copies of guarantees/warrantees for each item of equipment or systems.
7) Test data and system balancing reports.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) Temperature control diagrams and literature.
11) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
12) Commissioning and Preliminary Operation Tests required as part of the Work.

2. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Division 01 for additional requirements.
2. Upon completion of the Work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.

1) RFI, ASI, CCD references pasted onto contract documents or final shop drawings by the Contractor, or provided as reference, does not suffice as record of the as-built conditions.

The Contractor shall document the as-built conditions showing Work exactly as installed using red-lined markups of the contract documents or final shop drawings.

b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see "Submittals."
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.

C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.

D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:

1. HVAC and refrigeration equipment shall not contain CFCs.
2. HVAC and refrigeration equipment shall not contain Halons.

2.03 ELECTRIC MOTORS

A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. U.S. Motors.
b. Century Electric.
c. General Electric.
d. Lincoln.
e. Gould.

B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.

1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers:

a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
f. Each motor shall be provided with a shaft grounding device for stray current protection.

3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Select motors with service factor of 1.15.
2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

a. Permanent-split capacitor.
b. Split phase.
c. Capacitor start, inductor run.
d. Capacitor start, capacitor run.

3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:

a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

1) Exceptions:

a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
b) Motors installed in space conditioning equipment certified under California Energy Code Section 110.1 or 110.2.

4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
7. Motors 1/20 HP and Smaller: Shaded-pole type.
8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.04 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.

1. All starters shall have the following:

a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
b. Ambient compensated thermal overload.
c. Fused control transformer (for 120 or 24 volt service).
d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.

2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
4. Provide OSHA label indicating the device starts automatically.

2.05 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated doors where located in internally insulated ducts or casings.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated" where required.

2.06 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.07 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.08 EQUIPMENT IDENTIFICATION

A. Refer to Section 23 05 53 – Mechanical Identification.

2.09 PIPE IDENTIFICATION

A. Refer to Section 23 05 53 – Mechanical Identification.

PART 3 - EXECUTION

3.01 EXISTING MATERIALS:

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in

Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing refrigerant recovery: Contractor shall recover all refrigerant from existing HVAC equipment being demolished, and deliver to District in contractor provided tanks.

3.02 FRAMING, CUTTING, AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.03 MECHANICAL DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Items to be salvaged and returned to District:

1. All existing direct digital control (DDC) system components including, but not limited to: duct air temp sensors, duct pressure sensors, damper actuators, water temp sensors, water flow sensors, valve actuators, DDC unit controllers, zone temp sensors, zone CO2 sensors, door/window switches, current sensors, control relays (RIBs), duct smoke detectors, etc.
2. All existing refrigerant evacuated from existing hvac systems to be demo'd. Contactor shall deliver evacuated refrigerant to District M&O facilities in contractor provided tanks.

3.04 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.05 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.06 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

a. Black Steel Piping:

1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.

2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.07 EXCAVATING

A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

C. Maintain all warning signs, barricades, flares, and red lanterns as required.

D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.08 BACKFILLING

A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.

B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.

1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.

C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.09 UNION AND FLANGE INSTALLATION

A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller 3 or flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.

C. Locate the unions for easy removal of the equipment, tank, or valve.

D. Do not install unions or flanges in refrigerant piping systems.

3.10 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.11 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.12 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.

    a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.

2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.13 PIPE IDENTIFICATION

A. Refer to Section 23 05 53 – Mechanical Identification.

3.14 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.15 OPERATION OF SYSTEMS

A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.16 TEMPORARY HEAT

A. The General Contractor will provide for all temporary heat at such times as may be required or directed by the Architect and pay all fuel and energy costs incurred.

B. Temporary heating facilities proposed for use by the Contractor will be subject to review of the Architect. Prior to use of any equipment for temporary heat, install temporary filters on all return air inlets, to preclude dust and construction debris from entering the duct system. In addition, install filters in air handling units, and replace at the completion of temporary operation.

C. Filters used for temporary operation of systems shall be as specified for permanent filters specified herein.

D. Comply with Check, Test and Start Requirements for start-up of equipment prior to operation for temporary heat.

E. Contractor shall complete the permanent heating system as soon as possible, thereby making it available for temporary heat. When available, the system may be used as required at the direction of the Architect after systems are properly prepared for use as specified elsewhere. Contractor shall then be responsible for operating the system during periods required and the General Contractor shall pay the fuel and energy costs incurred. Operation of the heating system prior to the filing of "notice of completion" shall not change the Guarantee provisions in any way.

3.17 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.18 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. Specified filters are installed and spare filters have been turned over to Owner.
4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
5. All equipment has been cleaned, and damaged painted finishes touched up.
6. Damaged fins on heat exchangers have been combed out.
7. Missing or damaged parts have been replaced.
8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
11. Preliminary test and balance work is complete, and reports have been forwarded for review.
12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.

4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Before handing over the system to Owner replace all filters with complete new set of filters.

D. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

E. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:

1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
4. Control systems shall be completely operable with settings properly calibrated and adjusted.
5. Rotating equipment shall be in dynamic balance and alignment.
6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

H. Pre-Occupancy Building Purge:

1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C’s prior to occupancy.
2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.19 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 23 05 53

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 09 90 00 - Paints and Coatings: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

A. See Section 00 72 00 - Submittals, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: Equipment, control panels 1 inch.

3. Letter Height: Thermostats and small control components, 1/4 inch.

4. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

B. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Ductwork: Minimum 1-1/4" high letters.

2. Access Doors and Similar Operational Instructions: Minimum 3/4" high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

D. Service Markers: Identify buried plugged or capped pipe with concrete marker, 4-inch diameter by 30 inches long, set flush with grade. Provide engraved brass nameplate identifying pipe stub.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify domestic hot water heating equipment, including water heaters, pumps, expansion tanks, etc. with plastic nameplates.

G. Identify air conditioning units, makeup air units and exhaust fans with plastic nameplates.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to fan unit and/or zone unit with nameplates.

J. Identify valves in main and branch piping with tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

N. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 REFERENCES AND STANDARDS

A. Associated Air Balance Council (AABC)

1. National Standards for Total System Balance, latest edition.

B. National Environmental Balancing Bureau (NEBB)

1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.04 DEFINITIONS

A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.

B. Similar Terms: The following table is provided for clarification only:

Similar Terms		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems

TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

C. AABC: Associated Air Balance Council.

D. NEBB: National Environmental Balancing Bureau.

E. TAB: Testing, adjusting, and balancing.

F. TAB Organization: Body governing practices of TAB Specialists.

G. TAB Specialist: An entity engaged to perform TAB Work.

1.05 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.06 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

1. Provide list of similar projects completed by proposed TAB field supervisor.
2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.

C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

1. Submit examinations report with qualifications data.

D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.

F. Certified TAB reports.

1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.07 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.08 QUALITY ASSURANCE

A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.

B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:

1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.

a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.

2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.

a. TAB technician shall have minimum 4 years TAB field experience.

C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.

D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.

E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.

1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.

F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.

G. TAB Standard:

1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:

a. AABC National Standards for Total System Balance, or
b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.

H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect offices of Capital.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.

2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.

I. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.

K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

L. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

M. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.09 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.10 WARRANTY

A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:

1. AABC Performance Guarantee.
2. NEBB Quality Assurance Program.

B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contract Documents Examination Report:

1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:

a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
b. Proposed corrective action necessary for proper system operation.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report conditions requiring correction discovered before and during performance of TAB procedures.

P. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:

1. General description of each air system and sequence(s) of operation.
2. Complete list of measurements to be performed.
3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
4. Qualifications of personnel assigned to Project.
5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.
6. Table indicating pressure relationships (positive, negative, or neutral) between building spaces.
7. Air terminal correction factors for the following:

a. Air terminal configuration.
b. Flow direction (supply or return/exhaust).
c. Effective area of each size and type of air terminal.
d. Air density.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation." Section 23 80 00 Heating, Ventilating, and Air Conditioning.”

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.

C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.

1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.

E. For variable-air-volume systems, develop a plan to simulate diversity.

F. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

G. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

I. Verify that motor starters are equipped with properly sized thermal protection.

J. Check dampers for proper position to achieve desired airflow path.

K. Check for airflow blockages.

L. Check condensate drains for proper connections and functioning.

M. Check for proper sealing of air-handling-unit components.

N. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts." Section 23 80 00 “Heating, Ventilating, and Air Conditioning.”

O. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

P. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

E. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.

F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.

G. Do not overpressurize ducts.

3.06 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the condition of filters.
4. Check the condition of coils.
5. Check the operation of the drain pan and condensate-drain trap.
6. Check bearings and other lubricated parts for proper lubrication.

7. Report on the operating condition of the equipment and the results of the measurements taken. Report conditions requiring correction.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Conditions requiring correction noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.07 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.08 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.

3. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Project Performance Guaranty
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.

3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.

f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Relief airflow in cfm.
l. Outdoor-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
m. Return-air damper position.
n. Relief-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
o. Vortex damper position.

H. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.

I. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.

b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft.
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

J. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

K. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

L. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

3.09 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.

D. Prepare test and inspection reports.

3.10 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 09 23

ENERGY MANAGEMENT CONTROL SYSTEM – DESIGN-BUILD

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Provide a complete operational EMS (Energy Management System) per the requirements of this section.

B. Provide a Metasys control system to be integrated into the existing Metasys control system on campus.

C. Refer to Basic Mechanical Requirements Section, for general mechanical requirements.

D. Refer to Mechanical Division for installation of instrument wells, valve bodies, dampers, etc. in mechanical systems.

E. Provide the following electrical work as work of this Section, complying with requirements of Electrical Division, and as outlined below:

1. All control wiring between field-installed controls, indicating devices, and unit control panels.

2. Interlock wiring between electrically interlocked devices, sensors, and between a hand or auto position of motor starters as indicated.

3. Wiring associated with indicating and alarm panels (remote alarm panels) and connections to their associated field devices.

4. Contractor shall provide and extend low voltage power source wiring required for operation of control devices provided.

5. Wiring for fully complete and functional controls system and as specified.

F. Furnish a totally native BACnet-based system, including the Microsoft compatible operator's workstation, if a workstation is required. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2008, BACnet. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.

G. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

H. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

I. Design, provide, and install all equipment cabinets, panels, data communication network cables needed,

and all associated hardware.

J. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

K. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

L. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals, logic, process & instrumentation drawings) on approved media, the sum total of which accurately represents the final system.

M. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

N. DDC controls and communication wiring shall be installed in conduit maintaining an independent pathway and shall not share other disciplines/trades pathways.

O. Survey the entire site area defined in the project and identify all existing mechanical equipment prior to award of contract to determine full scope of work.

P. Controls contractor shall determine if current control system requires a BCM upgrade to Metasys MUI and if there is any equipment not shown on the controls drawings or acknowledge the equipment list for the project that will require controls for a complete system and inform the owner.

Q.

1.02 SUBMITTALS: IN ACCORDANCE WITH DIVISION 1

A. Product Data: Submit manufacturer's specifications for each control device furnished, including installation instructions and start-up instructions. Submit integrated wiring and electrical diagram to show complete system operation.

B. All submittals must be received and approved by the Owner prior to the ordering and installation of any equipment by the Contractor.

1. Provide the Owner with a Building Controls submittal with the following:

a. System Hardware

b. System Architecture

c. Complete System Wiring Schematic

C. Submit shop drawings showing construction and mounting details for review prior to construction. In addition, submit the following for review prior to panel and/or system fabrication and installation:

1. Field wiring diagrams showing wiring external to panel.

2. Panel internal wiring diagrams also showing panel terminal connections for external wiring,

properly coordinated and keyed to external wiring diagram.

3. Designation of all switches, pilot lights, etc. and layout of instruments, switches, and nameplates of panel.

1.03 COORDINATION:

A. Automatic temperature control systems work shall be accomplished as outlined below:

1. Control Valves furnished under this section shall be installed as specified in Mechanical Division. .

2. Control Dampers are provided under the applicable Mechanical Division air distribution or air handling equipment section.

3. Water Pressure Taps, Thermal Wells, Flow Switches, Flow Meters, that will have wet surfaces furnished under this Section, shall be installed as specified in Mechanical Division.

4. Controlled Equipment Power Wiring shall be furnished and installed under Electrical Division. Where control involves 120V control devices controlling 120V equipment, the Division 16 Electrical Contractor shall extend power wiring to the equipment and shall extend it from the equipment to the control device.

1.04 INSTALLING CONTRACTOR QUALIFICATIONS:

A. The Building Automation System Control System contractor shall be a factory branch office of the manufacturer. The contractor must have been in business, and licensed as a contractor by the State of California, installing HVAC and building automation controls, and fire/life safety systems, for a minimum of ten (10) years preceding the bid opening.

B. The Building Automation Control System contractor must have completed no less than one (1) control system installation, within twenty-four (24) months preceding the bid opening, pursuant to a single written contract, valued at no less than three hundred thousand ($300,000) dollars.

C. The Building Automation Control System contractor must demonstrate that, from the local office that will service the Owner with a four (4) hour emergency response requirement can logistically be provided.

D. Controls contractor must have direct access to factory certified instructors to provide training upon request of the district.

E. Controls contractor must have explicit district approval to interface with district wide server for integration of new controls system.

F. The Building Automation Control System contractor must have been, for five (5) years preceding the bid opening, and shall be a factory branch office for the product manufacturer type identified in subsection 2.01, A., under PART 2 – PRODUCTS, of this section. Factory authorized dealer means:

1. Installing Contractor has a contract directly with the factory. Approved installing contractors shall be Johnson Controls (JCI) Factory Branch office, Emcor, or Intech Mechanical. No others are approved.

1.05 RELATED WORK:

1.06

A. General Conditions - Division 0 and 1

B. Mechanical - Division 23

C. Electrical - Division 26

D. Low Voltage – Division 27

E. Fire Alarm – Division 28

F. Site Utilities – Division 31

PART 2 - PRODUCTS

2.01 GENERAL:

A. Manufacturer: The Building Automation Control System shall be provided by the following:

1. Controls are to be provided by Johnson Controls, Inc., branch office in Folsom, CA to match campus standard.

2. No other contractors are acceptable or will be considered per Part 1.4, Item F above.

3. The Building Automation Controls contractor must have been, for ten (10) years preceding the bid opening, a factory branch office. A contract with a distributer is not acceptable.

B. All new controls material must be fully integrated and graphically represented on existing district building automation controls system on the districts servers. Only district authorized personnel may access this server for controls integration.

C. All components used shall be serviceable, repairable, and replaceable by qualified temperature control technicians using non-proprietary parts, tools, and instruments.

2.02 SUPERVISORY CONTROLLER

A. SUPERVISORY NETWORK ENGINE (SNE) – EXISTING ON SITE

1. The SNE shall perform the function of monitoring all system variables, both from real hardware points, software variables, and controller parameters such as set points.

2. SNE’s shall be entirely solid state devices. No rigid disk drives will be permitted in the equipment rooms.

3. The SNE’s shall manage and direct all information traffic on the Tier 1 network, between the Tier 1 and Tier2 networks, and to servers.

4. Any SNE on the Tier 1 network shall be equipped with all software necessary to drive the complete

user interface including graphics on a browser connected to the SNE via the network or directly via a local port on the node.

5. The operating system of the SNE shall support multi-user access. At minimum four users shall be able to access the same SNE simultaneously.

6. Communication between SNE's shall be per-to-peer via 10/100 Ethernet using the BACnet protocol.

7. The SNE shall be capable of direct connection to multiple field busses using different protocols simultaneously as indicated below. Should the controller not support multiple field busses, install two supervisory controllers side by side.

    a. An RS-485 serial field bus such as BACnet MSTP or the manufacturer's proprietary field bus – JCI N2.

    b. A LON field bus for supervision and control of LON based controllers that conform to the Lon Talk standard.

8. The SNE will integrate data from both field busses into a common object structure. Data from both field busses will appear in common displays throughout the user interface in exactly the same format. It shall not be possible to determine which field buss the data originated on without reviewing the system configuration data.

9. The SNE shall be programmable and governed by the requirements of their applicable codes, approvals and regulations.

10. The SNE shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.

11. A failure at an SNE shall not cause failures or non-normal operation at any other system SNE other than the possible loss of active real-time information from the failed SNE.

12. Ancillary SNE equipment, including interfaces and power supplies, shall not be operated at more than 80% of their rated service capacity.

13. The SNE shall comply with FCC Part 15 subpart J class A emission requirements.

14. Each SNE shall be equipped with the necessary un-interruptible power such that it will not cease operation during minor power outages, including those that occur upon transfer to emergency generator or other local power source not provided by the utility.

2.03 NETWORKING/COMMUNICATIONS:

A. The design of the Building Automation Control System shall network operator workstations and Standalone DDC Panels as shown on the attached system configuration drawing. Inherent in the system's design shall be the ability to expand or modify the network(s) by adding additional supervisory network engines if and when engine capacities are exceeded. Each new engine installed as a part of this project shall have 25 percent spare capacity of both field controller count and BACnet object count.

1. Local Area Network

a. Workstation/DDC Panel Support: Operator workstations and DDC panels shall directly reside on the Owner's local area network such that communications may be executed directly between controllers, directly between workstations, and between controllers and workstations on a peer-to-peer basis.

b. Dynamic Data Access: All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all point status and application report data, or execute control functions for any and all other devices via the local area network. Access to data shall be based upon logical identification of building spaces via a space-based navigation bar. Spaces shall be programmed to be linked to the HVAC and other integrated equipment serving each space. Various "widget" screens shall allow users to view data in a variety of ways including but not limited to the following: Graphics (as defined in section 2.6), Equipment Summary, Equipment Serving Space, Equipment Activity, Trend, Schedules, and Potential Problem Areas. The interface shall also provide the operator with the choice of navigating via a BAS network tree that discloses details of the BAS system architecture and all connected points.. Access to system data shall not be restricted by the hardware configuration of the Building Automation Control System. The hardware configuration of the Building Automation Control System network shall be totally transparent to the user when accessing data or developing control programs.

c. General Network Design: Network design shall include the following provisions:

1) High-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. The minimum baud rate shall be one (1) Megabaud.

2) Support of any combination of controllers and operator workstations directly connected to the local area network. A minimum of fifty (50) devices shall be supported on a single local area network.

3) Detection and accommodation of single or multiple failures of either workstations, DDC panels or the network media. The network shall include provisions for automatically reconfiguring itself to allow all operational equipment to perform their designated functions as effectively as possible in the event of single or multiple failures.

4) Message and alarm buffering to prevent information from being lost.

5) Error detection, correction, and retransmission to guarantee data integrity.

6) Default device definition to prevent loss of alarms or data, and ensure alarms are reported as quickly as possible in the event an operator device does not respond.

7) Commonly available, multiple sourced, networking components and protocols shall

be used to allow the Building Automation Control System to coexist with other networking applications such as office automation. ETHERNET, is one acceptable technology.

8) Use of an industry standard IEEE 802.1x protocol. Communications must be of a deterministic nature to assure calculable performance under worst-case network loading.

9) Synchronization of the real-time clocks in all DDC panels shall be provided.

2.04 ADVANCED APPLICATION AND APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS:

A. Each Standalone DDC Controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and data base including:

1. Control Processes

2. Energy Management Applications

3. Operator I/O (Portable Service Terminal)

D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or any PC or portable operator's terminal connected to any DDC panel in the network.

E. Application Specific Controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include but not be limited to the following:

1. Display temperatures

2. Display status

3. Display setpoints

4. Display control parameters

5. Override binary output control

6. Override analog setpoints

7. Modification of gain and offset constants

F. Advanced Application General Purpose Controllers shall be included with an integral display screen. The capabilities of the integral display screen shall include but not be limited to the following:

1. Password protection

2. Display temperatures

3. Display statuses

4. Display setpoints

5. Display control parameters

6. Override binary output control

7. Override analog setpoints

8. View instantaneous point trends of up to two points simultaneously

G. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

H. Application Description:

1. General Purpose Controller (CGM) – BY JCI

a. When indoors - the CGMshall operate as a standard from 32 to 122 degrees Fahrenheit ambient air temperature and 10 to 90% relative humidity.

b. When outdoors mounted either in unit cabinet or mounted in a steel enclosure – the CGMshall operate from -40 to 158 degrees Fahrenheit ambient air temperature and 10 to 90% relative humidity.

c. The CGM shall be certified as a BTL listed B-AAC controller.

d. The General Purpose Controller (CGM) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.

e. The CGM shall be capable of executing and handling the data storage requirements of ASHRAE Guideline 36 sequences of operations without modifications to controller hardware or firmware regardless of whether or not Guideline 36 sequences are specified on this project.

f. The CGM shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

g. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

h. The CGM shall be assembled in a plenum-rated plastic housing with

flammability rated to UL94-5VB.

i. The CGM shall include a removable base to allow pre-wiring without the controller.

j. The CGM shall include troubleshooting LED indicators to identify the following conditions:

1) Power On

2) Power Off

3) Download or Startup in progress, not ready for normal operation

4) No Faults

5) Device Fault

6) Field Controller Bus - Normal Data Transmission

7) Field Controller Bus - No Data Transmission

8) Field Controller Bus - No Communication

9) Sensor-Actuator Bus - Normal Data Transmission

10) Sensor-Actuator Bus - No Data Transmission

11) Sensor-Actuator Bus - No Communication

k. The CGM shall accommodate the direct wiring of analog and binary I/O field points.

l. The CGM shall support the following types of inputs and outputs:

1) Universal Inputs - shall be configured to monitor any of the following:

a) Analog Input, Voltage Mode

b) Analog Input, Current Mode

c) Analog Input, Resistive Mode

d) Binary Input, Dry Contact Maintained Mode

e) Binary Input, Pulse Counter Mode

2) Binary Inputs - shall be configured to monitor either of the following:

a) Dry Contact Maintained Mode

b) Pulse Counter Mode

3) Analog Outputs - shall be configured to output either of the following

a) Analog Output, Voltage Mode

b) Analog Output, current Mode

4) Binary Outputs - shall output the following:

a) 24 VAC Triac

5) Configurable Outputs - shall be capable of the following:

a) Analog Output, Voltage Mode

b) Binary Output Mode

m. The CGM shall reside on a LEVEL 2, Field Controller Bus (FC Bus).

1) The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

2) The FC Bus shall support communications between the CGM's and the SNE.

3) The FC Bus shall also support Input/Output Module (XPM) communications with the CGM and with the SNE.

4) The FC Bus shall support a minimum of 100 XPMs and CGM in any combination.

5) The FC Bus shall operate at a maximum distance of 15,000 ft. between the CGM and the furthest connected device.

n. The CGM shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

1) The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

2) The SA Bus shall support a minimum of 10 devices per trunk.

3) The SA Bus shall operate at a maximum distance of 1,200 ft. between the FEC and the furthest connected device.

o. The CGM shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.

p. The CGM shall support, but not be limited to, the following:

1) Hot water, chilled water/central plant applications

2) Built-up air handling units for special applications

3) Terminal units

4) Special programs as required for systems control

2. Network Sensors (NS)

a. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:

1) Zone Temperature

2) Zone humidity

3) Zone setpoint

b. The NS shall transmit the zone information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.

c. The Network Sensors shall include the following items:

1) A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint.

2) An LED to indicate the status of the Override feature.

3) A button to toggle the temperature display between Fahrenheit and Celsius.

4) A button to initiate a timed override command

d. The NS shall be available with either screw terminals or phone jack.

e. The NS shall be available in either surface mount or wall mount styles.

2.05 TEMPERATURE CONTROL MATERIAL:

A. PANEL DEVICES

PART #	DESCRIPTION	MFTR
DCP-1.5-W	1.5 AMP POWER SUPPLY	KELE
DPT2640-005D	PRESSURE SENS, DP, 0-5”WC	SETRA
RH2B-UAC24-L	DPDT, 10A, HC=24 VAC, W/LED	IDEC
SH2B-05	DPDT RELAY BASE FOR RH2B	IDEC
RH4B-UAC24V	4PDT, 10A, HC=24 VAC	IDEC
SH4B-05	4PDT RELAY BASE FOR RH4B	IDEC
PXPLX01S	DP TRANSDUCER, AIR, 0-1”	VERIS
1900-5MR	HIGH STATIC PRESS. SWITCH	DWYER
BAM2	TB END STOP	KELE
FEM6	TB END STOP SECTION	KELE
M4/6	TERMINAL BLOCK	KELE
RC610B	TB BLANK MARKING STRIPS	KELE
Y65A13-0	120VAC/24VAC, FOOT, 40VA	JCI

Y65A21-0	120VAC/24VAC, PLATE, 40VA	JCI

B. TRANSDUCERS

PART #	DESCRIPTION	MFTR
A-306	OUTDOOR AIR STATIC	KELE
DPT-2015-1	DIFF PRESS TRANSMITTER	JCI
DPT2090-250G	PRESS SENS, GAGE, 250 PSI, VDC	SETRA
DPT2640-0R1B	PRESS SENS, DP, -0.1-0.1”WC, VDC	SETRA
DPT2640-2R5D	PRESS SENS, DP, 0-2.5”WC, VDC	SETRA
FTG18A-600R	REMOTE MTD PROBE	JCI
PWLX03S	DIFF PRESS, WATER, 0-25PSI	VERIS

C. SENSORS

PART #	DESCRIPTION	MFTR
TE-6000-1	SENSOR, T-NI, 1.0%, STRAP-ON	JCI
TE-6001-3	KIT, MTG BOX FOR WZ-1000 WELL	JCI
TE-6313P-1	SENSOR, T-NI 0.1%, 3IN OAT	JCI
TE-6316P-1	SENSOR, T-NI, 0.1%, 17FT AVG	JCI
TE-6311V-2	DUCT PROBE TEMP. SEN. 1K	JCI
TE-67NP-0N00	SENSOR, RM, 1K, NI, PHONE JACK	JCI
TE-67NT-0N00	TEMP SENSOR 1K NICKEL	JCI
NSB8BHC141-0	TEMP SENSOR, RH, CO_2 W/ WC LEVER	JCI
NSB8BHN141-0	TEMP SENSOR, RH W/ WC LEVER	JCI
NSB8BTN141-0	TEMP SENSOR W/ WC LEVER	JCI
NS-BTP7002-0	ZONE TEMP SENSOR/SETPT	JCI

(DISCONTINUED)
ADDRESSABLE ZONE TEMP JCI (REPLACED BY NSB8BTN140-0)

NS-BCN7004-0	CO2 SENSOR W/MOD JACK	JCI
A/1KHT-2W-RP	REMOTE PROBE,-40-842, PT, 1K	ACI
A11A-1C	PLN, MLT, SP=35-45 F, STG=1	JCI
TEC-2601-4	1 HEAT/1 COOL BACnet STAT	JCI
LX-24	CEILING MOUNT OCC SENSOR	KELE
ST-S63-XH	S.S ZONE TEMP WITH OCC OVR	KELE

D. FIELD DEVICES

PART #	DESCRIPTION	MFTR
H922	CURENT SENSOR, SPLIT	VERIS
ST-S63-XM	STAINLESS STEEL ZONE TEMP	KELE
TS-400-24-W	DIGITAL TIME SWITCH	KELE
TS-470	END SWITCH, NO	KELE
WZ-1000-5	WELL, BRASS, 2-3/8 IN, ½ IN NPT	JCI
M9104-AGS-2N	ELEC, INCR, NSR, TQ=35	JCI
LF24ECONR10--US	DAMPER ACTUATOR, 35 IN-LB [4 NM], SPRING RETURN, AC/DC 24 V, MODULATING, 10 kΩ NTC	BELIMO
LF24-3-S US	35 IN-LB SPRING RETURN, AC/DC 24 V, ON/OFF, FLOATING POINT, 1x SPDT	BELIMO
LG 24-SR US	35 IN-LB SPRING RETURN, AC/DC 24 V, MODULATING, 2...10 V	BELIMO

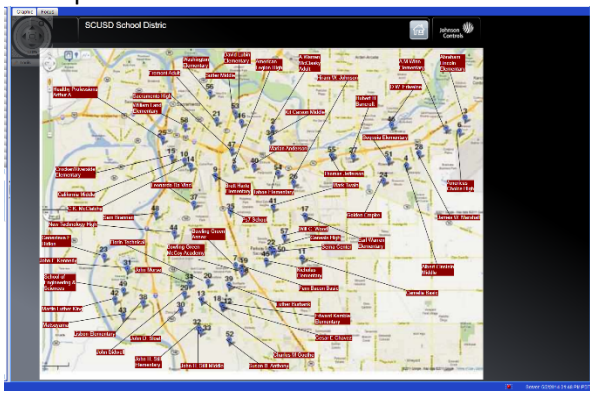
LF24-ECON-R10 US NTC	35 IN-LB, SPRING RETURN, AC/DC 24 V, MODULATING, 3 kΩ	BELIMO
M9220-BGA-3	DAMPER ACTUATOR 20 NM SR	JCI
AFX24-SR	DAMPER ACTUATOR 180 IN-LB (20 NM) SR	BELIMO
M4-CGM09090-0H	OUTDOOR OR INDOOR CGM	JCI
M4-SNE11002-0	MEDIUM CAPACITY SNE	JCI
M4-SNE22002-0	HIGH CAPACITY SNE	JCI

E. Motorized Control Dampers: Shall be parallel blade for two-position control and opposed blade for proportional control applications. Dampers shall have an enamel finish or be galvanized, with nylon bearings. Blade edge and tip seals shall be included for all dampers. Blade shall be double piece 22 gauge minimum and 8" wide maximum and frame shall be welded channel iron. Damper actuators shall be Belimo.

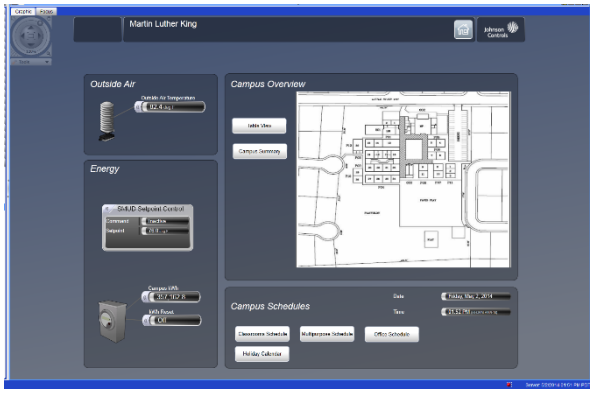
2.06 GRAPHIC INTERFACE

A. The following are examples of the district wide standard for the graphical interface of the controls system. The new controls system must be graphically represented according to the following templates. Label equipment name and AC number and area description.

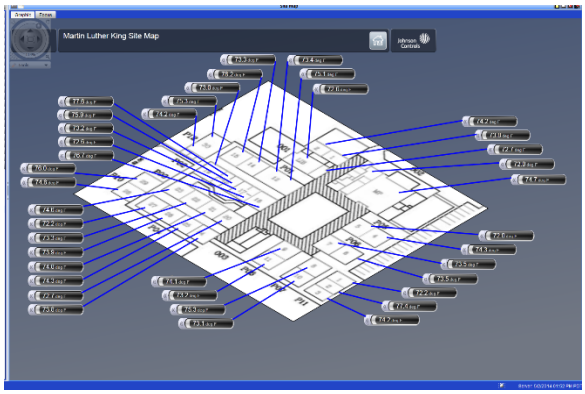
1. District Map View



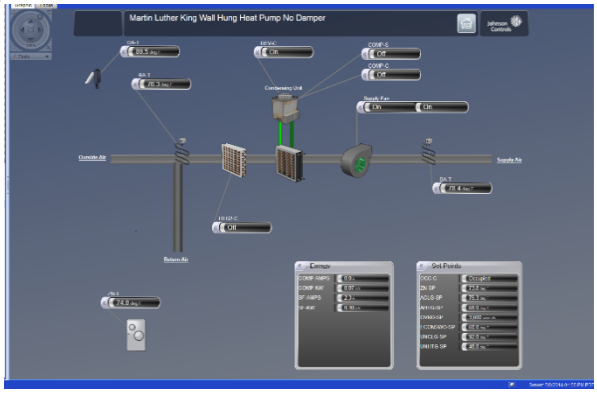
2. School Overview



3. Zone Overview



4. Equipment Overview



2.07 TRAINING SUPPORT

A. For this project, the manufacturer shall provide at a minimum 8 hours of training support services to review and provide recommendations and enhancements to the system, which may include:

1. Review of critical programming loops and adjustments as necessary

2. Adjustments to improve building system operation, reduce energy consumption and/or improve environmental control

3. Implementation or enhancement of functionality in the system

2.08 MISCELLANEOUS DEVICES

A. General:

1. Provide sensors and control devices, as specified, indicated on mechanical plans, control flow diagrams and as required to meet specified performance. Where performance specifications exceed capabilities of hardware specified, performance governs.

2. Equip analog sensors with thermistors or 4 to 20 milliamp transmitters with built-in circuit protection against reverse polarity and supply voltage transients. The thermistors and transmitters shall be compatible with the DDC System.

3. All sensor wiring, analog or digital, input or output shall be capable of sharing single conduit runs without affecting signal performance.

4. The sensor range and type shall be suitable to the application.

5. Minimum contact rating of relays and switches shall be 10 amperes, 110 volts resistive.

6. Devices shall be UL listed for electrical safety where applicable.

7. All components of sensors exposed to process shall be rated to withstand 150 percent of maximum process temperature and pressure.

8. Thermal wells shall have extension for pipe insulation and threaded connection to pipe. Threaded connection shall be a minimum of ½-inch nominal pipe thread. Maximum insertion length shall be 6 inches or 75 percent of the pipe diameter whichever is smaller.

B. SPARE PARTS:

1. Provide the following spare parts.

2. One additional “programmable” or “application specific” terminal unit controller shall be furnished to the District for each type of “programmable” and “application specific” controller/equipment application.

2.09 DATA/POINT LIST:

A. The following functions and data shall be available graphically at the Operators Terminal for each unit:

FUNCTION AND DATA POINT	VIEW AND CHANGE	VIEW ONLY
SPACE TEMPERATURE		X
SPACE TEMPERATURE SET POINT	X	
SUPPLY AIR TEMPERATURE		X
RETURN AIR TEMPERATURE		X
OUTSIDE AIR TEMPERATURE		X
MAXIMUM SET POINT	X	
MINIMUM SET POINT	X	
COOLING SET POINT	X	
OUTSIDE AIR DAMPER POSITION (%)	X	
RELIEF DAMPER COMMAND	X	
CURRENT AFTER HOURS DESIRED	X	
MAXIMUM AFTER HOURS ALLOWED	X	
FAN STATUS (ON-OFF-LOCKOUT)	X	
HEATING STATUS		X
HEATING LOCKOUT SET POINT	X	
COOLING STATUS		X
COOLING LOCKOUT SET POINT	X	
DISCHARGE TEMPERATURE		X
COOLING ATTAINED TEMPERATURE		X

FUNCTION AND DATA POINT	VIEW AND CHANGE	VIEW ONLY
HEATING ATTAINED TEMPERATURE		X
COOLING ALARM SET POINT	X	
HEATING ALARM SET POINT	X	
DAY MODE COMMAND		X
WARMUP MODE COMMAND		X
COOL-DOWN MODE COMMAND		X
TIME SCHEDULE	X	
HOLIDAY SCHEDULE	X	
OVERRIDE HOURS ALLOWED	X	
ELECTRIC DEMAND ASSIGN		X
OUTSIDE AIR DAMPER	X	
EQUIPMENT RUNTIME	X	
SUPPLY FAN AMPERAGE		X

1. Entry of service mode shall be disabled on a zone basis from the host computer.

2. Each individual or packaged equipment shall have after-hours override bypass timer adjustable from 0.1 hr. to 9.9 hrs.

3. Each unit will be controlled by its wall mounted zone temperature sensor fan on or off for after-hours option or fan only operation, and heat or cool on or off. Each fan shall be switched so that user can turn the fan on for ventilation only regardless of the call for heating or cooling.

4. Override bypass timers shall not override central plant control systems. Bypass timer shall energize unitary equipment and/or local fans only.

PART 3 - EXECUTION

3.01 GENERAL:

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Direct Digital Control Building Automation Control System, as shown on the drawings and described herein.

B. All labor, material, equipment, and software necessary to meet the functional intent of the Building Automation Control System as specified herein and as shown on the drawings shall be included.

C. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein, or on the plans, that are required to meet the functional intent of the Building Automation Control System, shall be provided without additional cost to Sac City Unified School District.

D. Equipment furnished by Electrical and/or Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Wiring normally performed in field shall be furnished and installed by the Building Automation Control System contractor.

E. Control equipment having electrical connections only, which are furnished under this work, shall be installed and connected by the Building Automation Control System contractor. Electrical devices requiring wet side piping connections shall be installed by the Mechanical Contractor.

F. Clearly identify and label equipment and controls, such as starters, switches, relays, as to function and position with permanently engraved plastic nameplates. Label controller address and area description on thermostat. Multizone system zone descriptions must be clearly represented on each Thermostat/zone sensor and match the description on Metasys.

G. Wiring of control equipment in accordance with wiring diagrams and functional operation of the control system shall be the responsibility of the Building Automation Control System contractor. Color coded wire shall be installed based on industry standards for HVAC. Label each wire from controller to added devices for each piece of equipment Heat-shrink wrap with permanent ink label each end of cable, wire and tubing that extends from field I/O connection and all intermediate connections throughout length to controller connection. Include conductor with unique identification identified by equipment being controlled or monitored, followed by point identification. Wiring Labels: Match control drawings. Nameplates and Tags: Accurate and permanently attached. I/O points lists agree with naming conventions.

H. Final Adjustment of Equipment: After completion of installation, adjust temperature sensors, control valves, actuators, motors, and similar equipment provided under the scope of work of this section. Cooperate with the air balance contractor as required.

I. Perform final adjustment by specially trained personnel in direct employ by the manufacturer of the primary Building Automation Control System.

J. Connect control valves with threaded connections with sufficient unions to permit valves to be readily removed from their installed locations for servicing, without disturbing adjacent piping. In no case shall this be less than three unions for three-way valves and one union for two-way valves.

K. Wiring and raceways included with the BACS scope of works includes but is not limited to the following:

1. Power wiring for all controllers, sensors, relays and other equipment shall be taken from the local HVAC controls panels except equipment provided with dedicated supplies provided by Division 16.

2. Controls wiring shall be routed from the local HVAC controls panels.

3. Conduit shall be used for the following:

    a. All exposed and concealed low voltage wiring in all areas below 8 feet above floor level.

    b. All mechanical and equipment rooms, exterior locations and any other areas where physical protection and/or access is required as defined elsewhere in the contract documents.

    c. All in-wall drops to equipment monitoring and/or control points including but not limited to medical equipment, kitchen service equipment, elevator sump and other moisture sensors, water flow meters, equipment mounted alarms, etc.

    d. All areas where specifically indicated on the Drawings.

4. J-Hooks and or designated LV raceway shall be used for the following:

    a. All low voltage wiring above 8 feet above floor level in open and accessible areas where conduit is not required, to cable trays or other conduits.

    b. All areas where specifically indicated on the Drawings.

5. Conduit and J-Hook materials and installation requirements shall comply with the applicable sections of Division 16 unless specifically indicated otherwise on the Drawings.

L. No direct integration to BACnet card in Package unit, Split system. Must use external devices i.e CGM.

M. CO2 Device control and monitoring shall be through an external controller. The controller shall directly control O.A Damper actuator.

N.

3.02 WARRANTY:

A. The Building Automation Control System contractor shall provide a one-year warranty covering the Building Automation Control System, and all associated components installed by the Building Automation Control System contractor. Any manufacturing or installation defects arising during this warranty period shall be corrected without cost to the Owner. The Building Automation Control System contractor shall respond to the job site within a four (4) hour period for any emergency relating to the control system and associated components installed by the Building Automation Control System contractor. Warranty period shall commence after all operator instruction is completed and the entire system has been accepted by the Owner. The warranty period shall be 2-years commencing on the date of Notice of Completion.

3.03 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Owner's Representative. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.04 OPERATION TEST/SYSTEM COMMISSIONING:

A. Each piece of equipment shall be tested by the Building Automation Control System contractor to show that it will operate in accordance with designed requirements and provide written documentation of this test. Control system commissioning shall consist of a point per point conformation and system operational demonstration conducted jointly by the Building Automation Control System contractor and the University's Representative.

B. The mechanical contractor and BACS contractor/vendor will conduct two levels of Quality Assurance to verify that the required installation and performance of the Building Automation Control System as been met.

1. Static Commissioning:

a. A point to point examination and documentation of the successful installation of the BACS system and its components in its entirety.

b. The start up of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the Owner.

2. Dynamic Commissioning:

a. A point by point demonstration and documentation of the successful performance of the BACS system and its components in its entirety.

b. The verification demonstrations of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the Owner.

C. All new controller programming shall be backed up into the districts existing database.

D. As part of the operational test's the controls contractor shall demonstrate integration of new controls system into the existing server and BACS.

E. In General the Commissioning process will comprise the following:

1. Review of points list and documentation.

2. Installation compliance with project plans and specifications.

3. Point-to-point check.

4. Control devices calibration and operation.

5. System programming and documentation.

6. System endurance test.

7. Control loop trends.

8. Reports and alarms.

9. Analog input calibration.

10. Analog output check and spring ranges.

11. Digital input range set points.

12. Digital output in autolog.

13. Point by point performance verification.

14. O & M training and documentation.

15. Opposite season verification and documentation.

16. Review and document system architecture.

F. Prior to job closing, the controls contractor must provide and present drawings showing the physical location of the new Field Control bus routing around the campus. This will be reviewed by district HVAC personnel.

G. TEMPERATURE CONTROL SYSTEM INSTALLATION

1. Provide thermostats for each HVAC system. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

2. Space Thermostat Temperature Setpoints based on Metasys.

a. Occupied Setpoints:

1) Standard; 69F Heat Maximum, 73 ˚F Cool Minimum.

2) Energy Saving; 68 ˚F Heat Maximum, 74 ˚F Cool Minimum.

b. Unoccupied Setpoints;

1) Standard; 50 ˚F Heat Maximum, 90 ˚F Cool Minimum.

2) Energy Saving; 40 ˚F Heat Maximum, 95 ˚F Cool Minimum.

c. Warm/Cool Adjustments:

Warm/Cool Adjustment (Units)	EFFHTG-SP (°F)	EFFCLG-SP (°F)
+3	69	79
+2	68	78
+1	67	77
0	66	76
-1	65	75
-2	64	74
-3	63	73

d. Economizer Switchover; Standard 65°F, Energy Saving; 68°F.

e. Pre/Post Purge: Eliminated.

f. PID Loop Tuning: “OFF”

g. Optimal Start/Stop: “ON”

H.

3.05 OPERATOR INSTRUCTION:

A. During system commissioning and at such time acceptable performance of the Building Automation Control System hardware and software has been established, the Control Contractor shall schedule with the Owner’s Representative and provide eight (8) hours of on site, or off site, operator instruction to the Owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent representative familiar with the systems hardware, software, and accessories.

PART 4 - SEQUENCE OF OPERATION

4.01 CONTROL SEQUENCE:

A. Control sequence of each controller shall be programmed to provide the same operation as currently operated. If not possible the contractor shall note why and provide a resolution alternate sequence.

B. The EMS shall initiate a cooling request when space temperature rises above the occupied cooling setpoint. The EMS shall compare outside air temperature to the space's return air temperature upon a space sensor cooling request. The outside air (OSA) damper shall open for free-cooling when the OSA temperature is 2-degrees or more below the return air temperature and the OSA temperature is below the OSA lockout setpoint of 75-degrees (ADJ.). The EMS shall modulate the equipment unit's outside air and return air dampers to maintain the space's occupied cooling setpoint during economizer mode. The economizer dampers shall modulate to a minimum position when the discharge air temperature drops to 52°F (ADJ).

C. The AC unit initiates mechanical cooling mode when the economizer damper has been 100% open for more than 5-minutes or the economizer has been locked-out and the space temperature is above the occupied cooling setpoint and the outside air temperature is above the mechanical cooling, lock-out temperature (60°F, ADJ.).

D. The Trend Logs shall be a minimum of 24-hour with 5-minute increments of back log data. Data shall include a minimum of the following points.

1. Discharge Air Temperature (DA-T),
2. Zone/Space Temperature (ZN-T),
3. Supply Fan Status (SF-S),
4 Compressor Command (CMP-C),
5. Occupied Command (OCC-C),
6. Supply Fan Status (SF-S),
7. Heating Command (HTG-C),
8. Supply Fan Amps (SF-AMPS),
9. Compressor Amps (CLG-AMPS), and;
10. Zone/Space Carbon Dioxide (ZN-CO2).

4.02 PACKAGE SINGLE ZONE EQUIPMENT:

A. Each unit will be controlled by its own unit controller. The EMS will interface with the units to provide the control.

B. Each unit will be controlled via a wall mounted temperature and C02 (where required) sensor(s) with adjustments for room set point and bypass timer function.

C. Heating/cooling operation: Unit controller will compare heating/cooling set point with the space temperature and activate heating or cooling mode.

D. Data:

1. Fan status (on/off)
2. Current mode (heating/cooling)

3. Supply air temperature
4. Return air temperature only when equipment furnished with economizer.
5. Outside air damper position (%) only where package unit is indicated to be provided with the “Belimo Actuator” option and control drawings show economizer dampers to be controlled directly from the DDC control system.
6. Room temperature
7. Carbon Dioxide (CO2) in PPM units where required. Refer to mechanical drawings for CO2 sensor locations.
8. Run time meters on items 1, 2 and filters.
9. Relief air damper position (%) where unit is indicated to provide with the “Belimo Actuator” option and control drawings show dampers to be controlled directly from the DDC control system

E. Relief air dampers, “Belimo Actuator”, shall close during unoccupied hours and open during occupied hours. Dampers shall open to 100% when outside air fan enables.

END OF SECTION

SECTION 23 80 00

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof mounted heat pump units.
2. Air inlets and outlets.
3. Filters.
4. Ductwork.
5. Insulation.
6. Thermal hanger shield inserts.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 23 00 50, Basic HVAC Materials and Methods.

C. Section 23 05 53, Mechanical Identification.

D. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

E. Section 23 09 23, Energy Management Control System.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings:

1. Variable Refrigerant Flow System Conference: Installing contractor's foreman shall attend conference at Project site with design Engineer and equipment manufacturer's representative, to comply with requirements of this Section and manufacturer's installation requirements including but not limited to, the following:

a. Proposed deviations from system as shown and described in Contract Documents, including location of system components and impacts to refrigerant pipe sizing.

1) Provide Coordinated Layouts as required by this Section for use in discussion.

b. Refrigerant piping assembly practices.

c. General discussion, question and answer period.

d. Walk site with equipment manufacturer’s representative to identify conditions affecting installation of system as designed.

1.04 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.

1. Upon approval of submittal, provide manufacturer’s installation and operating instructions to the Project inspector for the following:

a. Fire dampers, smoke dampers, and combination smoke-fire dampers.

b. Type 1 kitchen exhaust field applied grease duct enclosures.

C. VRF Systems: Submit system documentation for a fully engineered system, including shop drawings, and wiring and control diagrams, showing location of required manufactured system components, component model numbers and capacities, and size and location of all field-installed components, including piping, required seismic and thermal expansion loops, and wiring. Identify proposed deviations from system as shown in Contract Documents.

D. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.05 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

C. Economizer Fault Detection and Diagnostics (FDD) System Data: For all air-cooled unitary direct-expansion units equipped with an economizer, provide data for third-party supplied California Energy Commission certified FDD controller, documenting compliance with the requirements of California Building Energy Efficiency Standards. Provide evidence of certification.

D. Record of pre-installation meeting.

E. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer's training program for variable refrigerant flow systems installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.

F. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.06 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.

C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.07 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. Belts: One set(s) for each belt-driven unit.

2. Provide one complete set(s) of MERV-13 filters for each 4" filter bank.

1.08 COORDINATED LAYOUT

A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.

2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

a. B.O.D. = 9'-0"

b. OFFSET UP 6"

c. B.O.D. = 9'-6"

3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.

C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.09 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.

3. All items of a given type shall be products of the same manufacturer.

4. Scheduled equipment performance is minimum capacity required.

5. Scheduled electrical capacity shall be considered as maximum available.

B. Pump types and sizes regulated by the US Department of Energy's "Energy Conservation Standards for Pumps" 10 CRF Parts 429 and 431 shall be marked with a compliant PEI_{CL} or PEI_{VL} (Pump Energy Index, constant or variable load) value, basic model number, and RPM on the nameplate. Regulated pumps shall be listed in the Hydraulic Institute (HI) Energy Rating database (er.pumps.org) and be assigned an Energy Rating as defined in the HI 40.5 program guide.

C. Variable Refrigerant Flow Split-System Heat Pump Installer Training: Installing contractor shall have completed training in installation and service of VRF system, by equipment manufacturer.

1. Installing contractor shall obtain, at his own cost, equipment manufacturer's VRF system service tool, unless service tool is normally resident on controller specified for this Project.

1.10 FIELD CONDITIONS

A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of services.

2. Do not interrupt services without Architect's written permission.

1.11 WARRANTY

A. Air Conditioning Unit, Roof-Mounted:

1. Compressor shall have a five-year warranty.

2. Standard heat exchanger shall have a ten-year warranty.

B. Heat Pump Unit, Roof-Mounted: Compressor shall have a five-year warranty.

C. Heating and Ventilating Unit: Heat exchanger shall have minimum 10-year warranty.

D. High Efficiency Furnace Unit:

1. Heat exchangers shall have a 20-year warranty.

2. Entire unit shall have a 5-year warranty.

E. Air Cooled Condensing Unit: Unit shall have 5-year limited compressor warranty.

F. Proprietary equipment and components: Equipment and components that are not readily available and on-the-shelf shall provide 5-year warranty expressly for the specific equipment and component.

G. All HVAC products shall be warranted for 2-years from the Date of Notice of Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.02 HEAT PUMP UNIT, ROOF-MOUNTED

A. Provide factory assembled single packaged outdoor rooftop mounted, electrically controlled electric cooling and heating unit, rated in accordance with ARI Standards 210/240 or 340/360, and ETL or UL listed and labeled, classified in accordance with UL 1995. Provide refrigerant charge R-454B, all internal wiring, piping, controls, and special features required prior to field startup. Design unit to conform to the following:

1. ASHRAE 15.

2. ASHRAE 90.1.

3. Insulation, adhesive, and all materials exposed to air stream shall meet NFPA 90A requirements for flame spread and smoke generation.

4. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

B. Unit shall be rated in accordance with ARI sound standards 270.

C. Unit shall be ETL or UL tested and certified in accordance with ANSI Z21.47 Standards as a total package.

D. Roof curb shall be designed to conform to NRCA Standards.

E. Unit shall be manufactured in a facility registered to ISO 9001:2000.

F. Unit shall be Energy Star qualified.

G. Cabinet:

1. Provide galvanized steel unit cabinet, bonderized and coated with a baked enamel finish.

2. All airstream interior surfaces shall be insulated with a minimum 1/2 inch thick, 1 lb density cleanable insulation. Heat compartment for optional electric heater shall be insulated with minimum 1/2 inch thick, 1 lb. density foil-faced insulation.

3. Cabinet panels shall be removable. Provide access panels for the filter, compressors, evaporator fan, and control box. Each external hinged access panel shall be insulated, with insulation encapsulated with panel or with sealed edges.

4. Return air filters shall be accessible through a dedicated tool-less removable access panel.

5. Fork lift slots shall be provided in unit base rail. Base rail shall be minimum 16 gauge.

6. Unit shall have a factory-installed internally sloped condensate drain pan, providing minimum 3/4 inch-14 NPT connections for both horizontal and alternate vertical drain configuration. See Drawings for drain configuration. Pan shall be removable for cleaning and maintenance. All drain pans shall conform to ASHRAE 62.1 self-draining provisions. Drain pan shall be outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog.

7. Unit shall have standard side and alternate field or factory installed thru-the-bottom power and control wiring connection capability.

8. Unit shall be field or factory convertible to horizontal air discharge.

H. Fans:

1. Centrifugal supply air blower (evaporator fan) shall have permanently lubricated bearings. Provide belt-driven double inlet fan wheel, centrifugal type with forward curved blades and adjustable sheaves. Fan wheel shall be steel, with corrosion resistant finish, dynamically balanced.

2. Evaporator-fan motors shall be continuous operation, open drip-proof, and thermally protected. Bearings shall be sealed, permanently lubricated ball-bearing type. Constant fan speed for unit

capacity less than or equal to 65,000 BTUH design capacity. Multi-speed for unit capacities greater than 65,000 BTUH design capacity.

3. Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades. Fans shall be dynamically balanced and discharge air upwards. Condenser-fan motors shall be totally enclosed and thermally protected.

I. Compressor:

1. Fully hermetic, scroll type with internal high-pressure and temperature protection. Furnish with crankcase heater when normally supplied as standard equipment for model size scheduled on Drawings. Two-stage package units with dual compressors shall be independently circuited.

2. Factory installed rubber shock mounted and internally spring mounted for vibration isolation.

3. Compressor Anti-Recycle Timer: Compressor shall be prevented from restarting for a minimum of five minutes after shutdown, with manufacturers installed compressor cycle delay.

J. Coils:

1. Standard evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless internally finned copper tubes with all joints brazed.

2. Condenser coils shall be single slab, single pass design. Single slab, 2 pass design may be utilized when supplied as standard equipment for unit size as scheduled on the Drawings.

3. Coils shall be leak tested at minimum 150 psig and pressure tested at minimum 450 psig.

4. Coils shall be copper fixed with aluminum fins without micro-channel coils.

K. Refrigerant Components:

1. Each refrigerant circuit shall include:

a. Fixed orifice metering device.

b. Solid core refrigerant filter driers with pressure ports.

c. Refrigerant pressure gage ports and connections on suction, and discharge lines.

d. Suction line accumulator.

e. Reversing valve.

L. Refrigerant Detection System:

1. Unit shall be provided with refrigerant detection system (RDS) that activates upon detection of refrigerant above the minimum threshold. The RDS shall connect to unit controls and automatically start a sequence to dilute refrigerant gas and alarm when it senses the presence of refrigerant in the cabinet. The RDS shall contain factory-installed sensors.Filter Section:

M. Standard filter section shall accommodate 2- inch deep filters. Filters shall conform to the “Air Filters” Article in this Specification Section.

1. Filter section shall use standard size filters.

N. Controls:

1. Unit shall be complete with self-contained low voltage fuse protected control circuit. Refer to Section 25 50 00, if included, and equipment schedule, sequence of operation and control diagram on Drawings for additional requirements.

2. When third party direct digital controls with an Energy Management System will be utilized, provide electro-mechanical controls with 24V thermostat interface.

3. When stand-alone thermostat operation is utilized, provide electro-mechanical controls with 24V thermostat interface or provide microprocessor controls.

4. When stand-alone thermostat operation is utilized for single-zone VAV units, provide microprocessor controls. Units shall have factory mounted supply fan variable frequency drives.

5. When third party direct digital controls with an Energy Management System will be utilized for single zone VAV units, provide microprocessor controls with BACnet or LON interface. Units shall have factory mounted supply fan variable frequency drives.

6. Electro-mechanical controls shall include the following, as a minimum:

a. Provide compressor minimum off time (5 minutes).

b. Economizer control.

c. Time delay relay.

d. Integrated adjustable defrost cycle.

7. Microprocessor controls shall be ASHRAE 62.1 compliant and include the following, as a minimum:

a. User diagnostic interface.

b. Unit control with standard suction pressure transducers and condensing temperature thermistors.

c. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard.

d. Service run test capability.

e. Shall accept input from a CO2 sensor (indoor) and provide demand ventilation control.

f. Provide compressor minimum off time (5 minutes).

g. Service diagnostic mode.

h. Economizer control.

i. Time delay relay.

j. Integrated adjustable defrost cycle.

O. Safeties:

1. Unit shall incorporate a solid-state compressor lockout that provides optional reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:

a. Compressor lockout protection provided for either internal or external overload.

b. Low-pressure protection.

c. Freeze protection (evaporator coil).

d. High-pressure protection (high pressure switch or internal).

e. Compressor reverse rotation protection.

f. Loss of charge protection.

g. Start assist on singe-phase units.

2. Supply-air sensor shall be located in the unit and detect both heating and cooling operation.

3. Phase Protection: Provide unit-mounted “SymCom,” or equal, Motor Saver three phase voltage monitor, model 201A or equal, adjustable voltage range for each unit, install per manufacturer's recommendations, mount in NEMA 3R enclosure if exposed to the weather.

a. Units shall provide the following features:

1) Low voltage fault trip and reset.

2) Voltage unbalance/phasing fault trip and reset.

3) High voltage fault trip and reset.

4) Transient Protection (Internal).

5) Automatic restart.

b. Provide each unit with 600V socket, “SymCom” model OT08, or equal.

P. Operating Characteristics:

1. Unit shall be capable of starting and running at 115° F ambient outdoor temperature per maximum load criteria of ARI Standards 210/240 or 340/360.

2. Unit with microprocessor or electro-mechanical controls shall operate in cooling down to an outdoor ambient temperature of 25° F.

3. Unit shall be provided with fan time delay to prevent cold air delivery in heating mode.

Q. Electrical Requirements:

1. All unit power wiring shall enter unit cabinet at a single location. Both unit side and bottom power entry provisions shall be provided. Refer to Drawings schedule for thru-the-bottom power wiring requirement.

2. Shall be sized not less than the compressor KW rating.

R. Motors:

1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.

2. Evaporator fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers.

3. Totally enclosed condenser-fan motor shall have permanently lubricated, sealed bearings, and inherent automatic-reset thermal overload protection.

4. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

5. Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.

S. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. TempMaster (York) – Basis of Desing

2. Carrier Corporation.

T. Provide the following additional features and equipment:

1. Roof Curb: formed galvanized steel with wood nailer strip capable of supporting entire unit weight. Provide 3 inch wide bottom flange.

2. Provide heavy-duty 18 gauge expanded metal coil guard grille to protect all surfaces of the condensing coil. Coil guard to by Micrometl is the basis of design.

3. Modulating Power Exhaust Economizer: Micrometl is the basis of design. Integrated type capable of simultaneous economizer and compressor operation.

a. Provide self-contained outdoor rooftop system, mounted directly to the return air compartment of the HVAC packaged equipment. Provide differential dry bulb economizer

control system and a factory programmed, fully programmable variable frequency drive package controlled by a differential pressure transmitter, mounted directly to the return air compartment of the HVAC packaged equipment. Design the system to continuously maintain space pressure, and provide capability of introducing up to 100 percent outdoor air.

1) Economizer control system shall be certified as meeting the requirements for Fault Detection and Diagnostics (FDD) in the California Building Energy and Efficiency Standards.

b. Provide outside differential pressure tubing termination with hex style pneumatic filter-muffler, minimum filtration 40 microns, 53 SCFM maximum at 100 psi, as manufactured by McMaster-Carr, or equal.

c. Provide hinged cabinet access doors and include latches to provide a tool-less entry for servicing. Power exhaust fan, VFD shall be installed in an enclosed cabinet accessible from outside the casing and without disrupting outside air flow.

d. Provide door lock on the power exhaust cabinet to meet ETL safety requirements.

e. Outdoor air intake dampers shall be low leak not to exceed 3 percent at 1 inch wg pressure differential and include stainless steel side seal and neoprene edge seal. Arrange dampers to close upon loss of power.

f. Provide belt driven exhaust blowers, double inlet, forward-curved centrifugal type. Provide gravity backdraft damper at fan outlet.

g. Provide fully programmable factory programmed variable frequency drive (VFD) package for each fan, driven by 4 to 20 mA signal from a differential pressure transmitter. Pressure transmitters shall measure 0 - 0.1 in wg. Install room sensor tubing with sensor tube termination installed within the room. Set space pressure setpoint to plus 0.01 above TAB measured upper outside air damper position space pressure and not greater than 0.04 in wg.

1) Where direct digital controls are utilized, provide Belimo damper actuator with end-switch, complete with spring return and all controls required to make the system fully operational.

2) Where stand-alone controls are utilized, provide Belimo damper actuatorwith end-switch, complete with spring return and all controls, including logic module, required to make the system fully operational.

h. Provide insect screen cover on outside ambient sensor.

U. Replenish for a period of two years without cost to the Owner all refrigerant and oil required to maintain the proper levels.

V. Owner Training: Manufacturer shall provide two initial on-site 4-hour training sessions for Owners' maintenance personnel. Manufacturer shall provide one 4-hour follow-up training session to be scheduled by Owner within one year of the date of the final initial training session. Training session agenda shall be as follows:

1. First session: Equipment.

2. Second session: Controls.

3. Follow-up session: Agenda by Owner.

2.03 AIR INLETS AND OUTLETS

A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.

C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

D. Opposed blade dampers are prohibited.

2.04 AIR FILTERS

A. Provide MERV 13 disposable pleated media type where supply duct is greater than 15-feet; otherwise, provide MERV 10. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:

1. Standards:

a. ASHRAE Standard 52.2-2007.

b. Underwriters Laboratories: U.L. 900, Class 2.

2. Construction:

a. Media: Synthetic or cotton-synthetic blend with radial pleats.

b. Media Frame: High wet-strength beverage board.

c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.

3. Performance: 2” deep filter shall have a maximum initial air resistance of 0.31 inches w.g.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Camfil Farr, Inc., model 30/30.

2. Flanders Corporation, model 40 LPD.

C. Temporary (Construction Period) Filters:

1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, before 30-days in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.

2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

D. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.05 DAMPERS

A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.

B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.

1. Rectangular Ductwork:

a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.

b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.

c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.

2. Round Ductwork:

a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.

b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.

3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

C. Fire Dampers and Combination Fire/Smoke Dampers:

1. Fire dampers and combination fire/smoke dampers shall be listed and approved by the California State Fire Marshal. Installation shall conform to the manufacturer's UL approved installation instructions.

a. Fire dampers shall be UL 555 classified and labeled as dynamic fire dampers approved for wall and floor installation. They shall ship from the manufacturer as an assembly with a minimum 20-gauge factory installed sleeve. Sleeve length shall suit the requirements of the wall construction. Each dynamic fire damper/sleeve assembly shall ship complete with factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dynamic fire dampers for vertical installation must consist of a single section on sizes up to 33" x 36" and a single section on sizes up to 24" x 24" for horizontal installation. 1-1/2 hour dynamic fire dampers shall be Ruskin DIBD20, Pottorff, or equal. 3 hour dynamic fire dampers shall be Ruskin DIBD230, Pottorff, or equal.

b. Fire dampers for high pressure/velocity systems where velocities exceed 2000 fpm and/or 4" w.g. pressure fire damper shall be Ruskin FD60, Pottorff, or equal.

c. Fire dampers for ceiling installation shall be UL 555C classified and labeled as ceiling dampers. They shall be provided with a thermal insulating blanket to fit the inlet or outlet condition if required by the application. Ceiling dampers shall be Ruskin CFD 2, 3, 4 or 5. Ceiling dampers for ceilings constructed of wood shall have UL tested in design L501 and shall be Ruskin CFD7, Pottorff, or equal.

d. Combination fire/smoke dampers. Dampers shall be UL classified and labeled as Leakage Class I Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment. Damper/actuator assembly shall be tested to full open and full close at minimum 2000 fpm 250° F heated air and 4" w.g. with airflow in both directions. (Specified select: 250° / 350°, 2000 fpm/3000 fpm). Each damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage resulting from instantaneous damper closure. Release device shall be EFL type and shall allow reset from outside the sleeve after moderate temperature exposure. (Replacement type fusible links not acceptable.)

e. Two position combination fire smoke dampers shall be equipped with one or more factory installed, direct coupled, 120 volt, single phase, electric actuator for energize open – fail close operation. Dampers with multiple actuators shall be factory wired with single point connection at the EFL heat release device for connection to power. Damper actuator shall include minimum one-year energized hold open (no cycles) and spring return (fail) close reliability. Damper/actuator shall include minimum 20,000 full open-full close cycle performances.

f. Modulating combination fire smoke dampers shall be equipped with one or more factory installed contact for modulating signal connection. Damper/actuator shall include minimum 100,000 full open-full close cycle performances with spring return (fail) close on loss of power.

g. Round combination fire smoke dampers up to 24" diameter shall be true round type with minimum 20 gauge galvanized steel designed for lowest pressure drop and noise performance. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17 inches minimum length and factory "roll formed" one-piece angles with pre-punched holes. Dampers shall be Ruskin FSDR25, Pottorff, or equal.

h. Round (larger than 24" diameter) or rectangular combination fire smoke dampers shall include roll-formed structural hat channel frame, reinforced at the corners, formed from a single piece of minimum 16 gauge equivalent thickness formed from single piece galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17" minimum length and factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dampers shall be Ruskin FSD60, Pottorff, or equal.

i. 3-hour rated combination fire smoke dampers shall be Ruskin model FSD60-3, Pottorff, or equal.

j. All FSD60 type dampers shall be AMCA licensed and shall bear the AMCA Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper.

k. Wall type fire/smoke damper:

1) Combination fire/smoke dampers for use in the wall of exit corridors shall be classified and labeled as Leakage Class II Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall meet the requirements for combination fire/smoke dampers in paragraph 3 above except AMCA certified testing shall verify pressure drop does not exceed .07" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper and blades shall be single skin galvanized steel 10 gauge minimum with 3 longitudinal grooves for reinforcement. Dampers shall be Ruskin FSD36, Pottorff, or equal.

2) Front access combination fire/smoke dampers shall meet all the requirements for combination fire/smoke dampers in paragraph 3 above except pressure drop requirement. In addition the dampers shall be constructed so that actuators and all accessories are accessible from the grille side. Actuators and accessories shall be housed within an integral cabinet on the side of the damper frame and shall not be installed in the air stream in front of the damper. The damper sleeve shall be minimum 14" and flanged to accept a steel framed grille. The sleeve shall be covered with fire resistant material. Dampers shall be Ruskin FSD60FA, Pottorff, or equal.

l. Ceiling type fire/smoke damper for tunnel type corridor construction: Combination fire/smoke dampers for use in the corridor ceiling of tunnel type corridor construction shall be UL classified and labeled as Corridor Damper. Dampers shall meet the requirements of paragraph 4a above except pressure drop testing does not require AMCA certification. Dampers shall be Ruskin FSD36C, Pottorff, or equal.

m. Fusible links shall have temperature rating approximately 50° F above normal maximum operating temperature of the heat producing appliance.

1) If project requires re-openable fire/smoke dampers, provide Ruskin 165 ° F / 350° F TS150, NCA or equal. The TS150 firestat replaces the EFL and allows the damper to be re-opened from remote location up to 350 ° F. TS150 shall include full open and full closed damper position contacts for interface with remote position indication panel.

2) Each fire/smoke damper shall be equipped with “controlled closure” quick detect heat actuated release device to prevent duct and HVAC component damage. Release device shall allow easy reset after moderate temperature rise outside the sleeve. Heat release device shall be the Ruskin EFL, NCA or equal.

3) Unless the system is using a validation control system, each fire/smoke damper shall be equipped with a control panel including blade position indicator lights and a key operated switch. The panel cover shall be oversized for flush mount into the wall or ceiling and shall have a brushed look. Control panel shall be Ruskin MCP2, Pottorff, or equal.

2. All actuators used for smoke dampers or combination fire/smoke dampers shall have a cycle time requirement of not more than every twelve months and shall be rated for continuous "0n" duty and shall be provided with internal spring return. Actuators shall be equipped with pilot light, remote key test switch, end switch and circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper. Electric motors shall be Belimo.

D. Where required to suit the size of damper required, provide manufacturers standard UL Classified mullions, arranged to support multiple dampers. Assembly shall be of minimum 16 gauge galvanized steel, complete with all accessory caps and framing members required for installation.

2.06 DUCTWORK

A. Construct and install sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.

1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.

2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.

3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.

4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.

5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.

    a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.

    b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.

B. Design and installation standards:

1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.

2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

3. California Mechanical Code.

C. Duct sizes indicated are external sizes.

D. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

1. Provide mill certification for galvanized material at request of the Project Inspector.

E. Duct Sealants:

1. Sealant shall have a VOC content of 250 g/L or less.

2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Design Polymerics, model DP1010.

2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.

3) McGill Airseal, LLC.

F. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.

G. Rectangular Duct Fabrication:

1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.

a. SMACNA HVAC Duct Construction Standards

b. California Mechanical Code

2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

Table A		
Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.

4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph “DAMPERS” for damper requirements.

5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

H. Rectangular Internally Insulated Duct Fabrication:

1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.

   a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.

   b. Where ductwork is within the building insulation envelope, lining shall be 1” thick, 1-1/2 pound density, with R-value of 4.2 minimum.

   c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

   d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).

   e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.

   f. Provide metal nosing at all locations where liner is preceded by unlined metal.

   g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.

      1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.

      2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.

   h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.

i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Manufacturer:	Product:
Johns Manville	Linacoustic RC
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

I. Round and Oval Ductwork Fabrication:

1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.

   a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.

      1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.

      2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.

2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.

3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam

37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.

5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

J. Round Internally Insulated Duct and Fittings: Where ductwork is exposed to weather or outside the building insulation envelope, construct with outer pressure shell, 2 inch thick (Minimum R-value = R-8) insulation layer, and perforated inner liner. Where ductwork is within the building insulation envelope, construct with outer pressure shell, 1 inch thick (minimum R-value = R4.2) insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 653, of spiral lockseam construction (use longitudinal seam for over 59 inches), in minimum gauges listed in table below. Where installed exposed in the conditioned space: duct and fitting outer pressure shell shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value = R-4.2) and perforated inner liner.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" TO 12"	26 gauge	24 gauge
13" TO 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 gauge	24 gauge
36" to 48"	18 gauge	24 gauge
Over 48"	16 gauge	24 gauge

2. Inner Liner: Perforate with 3/32 inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.

3. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.

4. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).

5. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.

6. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

   a. Sheet Metal Div., McGill AirFlow, LLC., Acousti-k27

   b. Semco Duct and Acoustical Products, Inc.

   c. Air Systems Manufacturing, Inc. - Las Vegas

K. Duct Access Doors:

1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.

2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

L. Flexible Air Ducts:

1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.

2) ThermaFlex model M KC.

2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.

3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.

4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1-inch negative static pressure.

M. Flexible Connectors:

1. Materials: Flame-retardant or noncombustible fabrics. Coatings and adhesives shall comply with UL 181, Class 1, with flame spread index of 25 or less, and smoke-developed index of 50 or less.

2. Metal-Edged Connectors: Factory fabricated with a fabric strip 3 inches wide attached to two strips of 3-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

3. Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

a. Minimum Weight: 26 oz./sq. yd.

b. Tensile Strength: Minimum 475 lbf/inch in the warp and minimum 375 lbf/inch in the filling.

c. Service Temperature: Minus 50 to plus 200 deg F.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Ductmate Industries, Inc., model Proflex.

b. Ventfabrics, Inc., model Ventlon.

2.07 TEMPERATURE CONTROL SYSTEM

A. Refer to Section 23 09 23, Direct Digital Control System for HVAC.

PART 3 - EXECUTION

3.01 ROOF MOUNTED EQUIPMENT INSTALLATION

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.

C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.

D. Verify that gas piping will be installed with sufficient clearance for burner removal and service.

E. Install gas flue extensions. Attach gas flue extensions to unit according to unit manufacturers' installation instructions. Terminate gas flue extensions with lowest discharge opening at height compliant with requirements of California Mechanical Code, based on final unit location.

F. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.

G. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.

H. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors. Provide G 90 galvanized steel weather hood over flexible connections exposed to the weather. Weather hood minimum gauge shall be per PART 2 article, Ductwork, Table A.

I. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

J. Condensate shall be routed on the roof to the nearest roof drain.

K. Equipment with economizer dampers and power exhaust fans shall furnish and install wire between Belimo damper actuator end-switch and power exhaust fan VFD input enable terminals.

3.02 FAN INSTALLATION

A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.

B. Provide access doors for fans or motors mounted in ductwork.

C. Mount all fans as detailed on Drawings and in compliance with CBC standards.

D. Fan motors mounted in air-stream to be totally enclosed.

E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.

F. Roof fans shall be mounted level.

G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.

H. Label fume hood fans with sign "CAUTION - HAZARDOUS EXHAUST."

3.03 RELIEF VENT INSTALLATION

A. Install relief vents to provide a level mounting for backdraft damper.

3.04 AIR INLETS AND OUTLETS INSTALLATION

A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.

C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.

2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.

D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.

E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

F. Air outlets throw direction(s) shall be adjusted to direct airflow away from air inlets and sensors, e.g. thermostats, temperature, return air, exhaust air, space pressure sensors or similar devices.

3.05 TEMPORARY FILTERS

A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.

1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.06 DAMPER INSTALLATION

A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.

B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.

C. Install fusible link fire dampers full size of duct at points where shown or required.

D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.

1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.07 DUCTWORK INSTALLATION

A. General:

1. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.

2. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealers shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.

3. Where ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

4. Horizontal runs of ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.

5. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.

6. Paint inside of ducts, visible through grille, dull black.

7. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.

8. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.

B. Firestopping:

1. Pack the annular space between duct openings and ducts penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

   a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Firestopping systems to be installed in strict accordance with manufacturer's instructions.

3. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

C. Flashing:

1. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

2. Refer to Division 07 specifications and Drawings details as applicable.

3. Flashing for penetrations of roof for mechanical items such as flues and ducts shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

   a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.

b. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

D. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

E. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

F. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

G. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

H. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

I. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.

1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.

2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.

3.08 DUCTWORK SEALING AND LEAK TESTING

A. All ductwork shall receive a Class A seal.

B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

C. Leakage Classes:

Pressure Class	Leakage Class	
	Round Duct	Rectangular Duct
2"W.G. or less	8	16
4"W.G. or greater	2	4

D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA “HVAC Air Duct Leakage Test Manual.” Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 23 08 00.13, “Title 24 Commissioning of HVAC.”

3.09 HANGER AND SUPPORT INSTALLATION

A. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Where building structural members do not match piping and ductwork support spacing, provide “bridging” support members firmly attached to building structural members in a fashion approved by the structural engineer.

1. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

    a. Provide copper-plated or felt-lined hangers for use on uninsulated copper tubing.

2. Materials and design for ductwork support shall be per SMACNA “HVAC Duct Construction Standards, Metal and Flexible.”

B. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.

C. For mechanical piping hanger and support requirements, refer to Section 23 05 29 – Mechanical Pipe Supports and Anchors.

D. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA “HVAC Duct Construction Standards, Metal and Flexible.”

E. Duct Support to Structure:

1. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

2. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

3. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

4. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

5. Exposed duct shall be restrained at the ends and elbows to 2-inches horizontal movement regardless of duct dimensions.

3.10 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.

2. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.

3. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.

4. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

5. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

6. Install insulation with longitudinal seams at top and bottom of horizontal runs.

7. Install multiple layers of insulation with longitudinal and end seams staggered.

8. Keep insulation materials dry during application and finishing.

9. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

10. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

11. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

12. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

13. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

14. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    a. Install insulation continuously through hangers and around anchor attachments.

    b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

    c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

    d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

B. Piping Insulation Installation:

1. General:

    a. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.

    b. Provide removable insulation covers for items requiring periodic service or inspection.

    c. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation.

    d. Provide pre-formed PVC valve and fitting covers for indoor piping.

e. Provide factory-fabricated aluminum valve and fitting covers for outdoor piping.

f. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

2. Below-Ambient Services Including Chilled Water Supply and Return and Refrigerant Piping:

a. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of woven glass fiber cloth saturated in Foster Sealfas 30-36, 3M, or equal, extending 3 inches over the adjoining pipe insulation. Finish with a coat of Foster Sealfas 30-36, 3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers.

b. Variable refrigerant flow (VRF) heat pump systems: Insulation for VRF system refrigerant piping shall be installed according to VRF unit manufacturer’s instructions.

3. PVC Jacket Installation:

a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

4. Aluminum Jacket Installation:

a. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

b. Do not install aluminum jackets on refrigerant flexible connectors to vibration isolated outdoor condensing units. Coat elastomeric insulation with insulation manufacturer’s recommended ultraviolet light protective coating.

C. Duct Insulation Installation:

1. General:

a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.

b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.

c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.

2. Mineral Fiber Blanket Installation:

a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

3. PVC Jacket Installation:

a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Equipment Insulation Installation:

1. General:

a. Insulate pumps, coil u-bends where exposed outside airstream, air separators, heating hot water and chilled water storage tanks, and other elements that are in series with the fluid flow, according to the requirements of the California Energy Code.

2. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, and for percent coverage of tank and vessel surfaces.

b. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.

c. Protect exposed corners with secured corner angles.

d. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

1) Do not weld anchor pins to ASME-labeled pressure vessels.

2) Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

3) On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.

4) Do not overcompress insulation during installation.

5) Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

6) Impale insulation over anchor pins and attach speed washers.

7) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

e. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.

f. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

g. Stagger joints between insulation layers at least 3 inches.

h. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

i. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

j. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

a. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

b. Seal longitudinal seams and end joints.

4. Insulation Installation on Pumps:

    a. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism. Do not enclose or insulate pump motor.

    b. Fabricate boxes from G90 galvanized steel, at least 0.050 inch thick.

    c. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

5. PVC Jacket Installation:

    a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

        1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

6. Aluminum Jacket Installation:

    a. Where aluminum jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 TEMPERATURE CONTROL SYSTEM INSTALLATION

A. Provide thermostats for each HVAC system. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

B. Space Thermostat Temperature Setpoints based on Metasys.

1. Occupied Setpoints; Standard 69F Heat Maximum, 74 ˚F Cool Minimum. Energy Saving; 68 ˚F Heat Maximum, 76 ˚F Cool Minimum.

2. Unoccupied Setpoints; Standard 50 ˚F Heat Maximum, 90 ˚F Cool Minimum. Energy Saving; 40 ˚F Heat Maximum, 95 ˚F Cool Minimum.

3. Warm/Cool Adjustments:

   a.

Warm/Cool Adjustment (Units)	EFFHTG-SP (°F)	EFFCLG-SP (°F)
+3	69	80
+2	68	79
+1	67	78
0	66	77
-1	65	76
-2	64	75
-3	63	74

4. Economizer Switchover; Standard 65°F, Energy Saving; 68°F.

5. Pre/Post Purge: Eliminated.

6. PID Loop Tuning: “OFF”

7. Optimal Start/Stop: “ON”

3.12 EQUIPMENT START-UP

A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.

B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.

C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.

D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.

E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.13 TESTING AND BALANCING

A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.14 CLEANING AND PROTECTION

A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.

D. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.15 EQUIPMENT MOUNTING

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.16 INDOOR DUCT INSULATION SCHEDULE

A. Ducts Located Within Building Thermal Envelope:

1. Minimum R-Value = R-4.2.

2. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.

B. Ducts Located Within Building Outside Thermal Envelope:

1. Minimum R-Value – R-8.0.

2. Supply and Return Ducts: Mineral Fiber Blanket, 3 inches thick, 0.75 lb/cu. ft.

3.17 OUTDOOR DUCT INSULATION SCHDULE.

A. Minimum R-Value = R-8.

B. Refer to article, Ductwork, for internal duct lining. Provide 2 inches thick internal duct lining where indicated on Drawings.

3.18 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

A. Insulated ducts in concealed spaces: None.

B. Insulated ducts in exposed unconditioned spaces: PVC, 20 mils thick.

3.19 EQUIPMENT INSULATION SCHEDULE

A. Insulate indoor and outdoor equipment that is not factory insulated.

B. Chilled-water pump insulation shall be the following:

1. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

C. Heating-hot-water pump insulation shall be the following:

1. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

D. Chilled-water expansion/compression tank insulation shall be one of the following:

1. Flexible Elastomeric: Thickness equal to insulation thickness for connected pipes.

2. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

3. Mineral-Fiber Pipe and Tank: Thickness equal to insulation thickness for connected pipes.

E. Heating-hot-water expansion/compression tank insulation shall be one of the following:

1. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

2. Mineral-Fiber Pipe and Tank: Thickness equal to insulation thickness for connected pipes.

F. Chilled-water air-separator insulation shall be one of the following:

1. Flexible Elastomeric: Thickness equal to insulation thickness for connected pipes.

2. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

3. Mineral-Fiber Pipe and Tank: Thickness equal to insulation thickness for connected pipes.

G. Heating-hot-water air-separator insulation shall be one of the following:

1. Mineral-Fiber Board: Thickness equal to insulation thickness for connected pipes and 3-lb/cu. ft. nominal density.

2. Mineral-Fiber Pipe and Tank: Thickness equal to insulation thickness for connected pipes.

3.20 INDOOR, FIELD-APPLIED EQUIPMENT JACKET SCHEDULE

A. Equipment, Concealed: None.

B. Equipment, Exposed: PVC: 20 mils thick.

3.21 OUTDOOR, FIELD-APPLIED EQUIPMENT JACKET SCHEDULE

A. All Equipment: Aluminum, Stucco Embossed. Thickness as follows:

Outer Insulation Diameter (Inches)	Minimum Aluminum Jacket Thickness (Inch)	
	Rigid Insulation	Non-Rigid Insulation (Note 1)
8 and Smaller	0.024	0.024
Larger Than 8 Thru 11	0.024	0.024
Larger Than 11 Thru 24	0.024	0.024
Larger Than 24 Thru 36	0.024	0.032
Larger Than 36	0.024	0.040

1. Note 1: Non-rigid Insulation is defined as having a compressive strength of less than 15 psi.

3.22 EQUIPMENT AND DUCT ACCESS PANELS

A. Cabinet position along with rooftop ductwork shall not block any equipment and duct serviceable access.

B. Proper clearance is required to remove equipment components.

C. Hinged access panels shall swing fully open to 180-degrees.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

SECTION NO.	SECTION TITLE
260010	BASIC ELECTRICAL REQUIREMENTS
260090	ELECTRICAL DEMOLITION
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260529	ELECTRICAL HANGERS AND SUPPORTS
260531	CONDUIT
260533	BOXES
260553	ELECTRICAL IDENTIFICATION
260942	DIGITAL LIGHTING CONTROL
262416	PANELBOARDS
262719	SURFACE RACEWAYS
262726	WIRING DEVICES
262816	OVERCURRENT PROTECTIVE DEVICES
262819	DISCONNECT SWITCHES
265000	LIGHTING

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Rough-in.
8. Electrical installation.
9. Cutting, patching, painting, and sealing.
10. Field quality control.
11. Cleaning.
12. Project closeout.

C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.

1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.

2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.

3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.

4. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.

5. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, luminaires, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.

6. Miscellaneous lumber and framing work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.

7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. Refer to Division 07, Thermal and Moisture Protection.

8. Access panels and doors: Required in walls, ceilings, and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.

9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.

10. Luminaire supports: Provide slack support wire for luminaires installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:

1. Electric motors.

2. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.

1.02 QUALITY ASSURANCE

A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

1. California Electric Code (CEC).
2. California Building Code (CBC).
3. California Fire Code (CFC).
4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

E. Independent Testing Agency qualifications:

1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.

F. All base material shall be ASTM and/or ANSI standards.

G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.

H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:

1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.

2. "Furnish": Shall mean purchase and deliver to Project site.

3. "Install": Shall mean to physically install the items in-place.

4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.

5. "As directed": Shall be as directed by the Owner or their authorized Representative.

6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

A. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.

B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in

conformance with the 2025 California Building Code (CBC) and ASCE 7-16. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use Ip=1.5. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.

G. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.

H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD) or building information modeling (Revit) system for submission by the Contractor. The Engineer can provide CAD or Revit files of the electrical Contract Documents to the Contractor.

1. Digital Lighting Controls, Section 260942.
2. Photovoltaic Power System, Section 263100.

J. Independent Testing Agency report:

1. Testing Agency shall provide 3 copies of the complete testing report.
2. Test report shall include the following:
    a. Summary of Project.
    b. Description of equipment.
    c. Equipment used to conduct the test.
        1) Type.
        2) Manufacturer.
        3) Model number.
        4) Serial number.
        5) Date of last calibration.
        6) Documentation of calibration leading to NIST standards.
    d. Description of test.
    e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
    f. Conclusion and recommendation.
    g. Signature of responsible test organization authority.

3. Furnish completed test report to Engineer no later than 30-days after completion of testing, unless otherwise directed.

K. Substitutions:

1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.

2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.

3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.

4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.

5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.

6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor’s, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

A. Discrepancies:

1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.

2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors,

ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.

2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:

1. Drawings:

a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.

b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.

2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD) process. Electronic files of the electrical construction documents will be provided to the Contractor by the Engineer.

3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:

a. Final electrical installation.

4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
    a. Digital Lighting Controls, Section 260942.
    b. Photovoltaic Power System, Section 263100.
5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
    a. One set of full size reproducibles.
    b. Electronic files of Drawings in PDF and CAD.

B. Panel schedules:
1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.
2. A single set of the record panel schedules shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
    a. Fold and insert one copy of the appropriate schedule in the pocket of the inner door of each panelboard.

C. Field labels, markings, and warning signs: Provide in accordance and as required by:
1. General: CEC Article 110.21.
2. High-Leg System: CEC Article 110.15.
3. Arc-Flash Warning: CEC Article 110.16.
4. Identification of Disconnecting Means: CEC Article 110.22 (A).
5. Engineered Series Combination Systems: CEC Article 110.22 (B).
6. Tested Series Combination Systems: CEC Article 110.22 (C).
7. Available Fault Current: CEC Article 110.24.
8. Depth of Working Space in Existing Buildings: CEC Article 110.26 (A)(1)(c).
9. Guarding of Live Parts: CEC Article 110.27 (C).
10. Locked Rooms or Enclosures: CEC Article 110.34 (C).
11. Manholes: CEC Article 110.75 (E).

1.07 OPERATION AND MAINTENANCE MANUALS

A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 COMMON REQURIEMENTS FOR ELECTRICAL INSTALLATION

A. All work shall be installed in a neat, workmanlike manner in accordance with ANSI/NECA 1-2015.

B. Comply with the requirements of all listed codes and standards.

C. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL.

D. All equipment of the same type and capacity shall be by the same manufacturer.

E. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

F. During construction the contractor shall at all times maintain electrical utilities of the building without interruption. Should it be necessary to interrupt any electrical service or utility, the contractor shall secure permission in writing from the owner’s representative for such Interruption at least ten (10) business days in advance. Any interruption shall be made with minimum amount of inconvenience and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary power source as required by project conditions.

G. Working clearance around equipment shall not be less than that specified in the CEC for all voltages specified.

H. The locations of switches, receptacles, lights, motors, etc. outlets shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with ducts, piping, etc. The contractor shall check all door swings so that light switches are not located behind doors. Relocate switches as required, with approval from the Design Professional. The owner’s representative may direct relocation of outlets before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.

I. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.

1. Where the owner’s representative determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the owner.

2. “Conveniently Accessible” is defined as being capable of being reached without climbing or crawling over or under obstacles such as motors, pumps, belt guards, transformers, racks, piping, ductwork, raceways or similar.

J. Owner furnished equipment: Equipment furnished by the District shall be received, stored, uncrated, protected, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself and shall hold the warranty

3.02 ROUGH-IN

A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.

B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.

C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.03 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:

1. Shop Drawings prepared by Manufacturer.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

11. Coordinate electrical systems, equipment, and materials installations with other building components.
12. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
13. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
14. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.04 CUTTING, PATCHING, PAINTING AND SEALING

A. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Cut, remove, and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.

G. Application of joint sealers:

1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.05 FIELD QUALITY CONTROL

A. General testing requirements:

1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer’s tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.

4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.

2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.

3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.

4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.

5. Voltage check:

a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.

b. Adjust taps on transformers to give proper voltage, which is 118 to 122volts for 120volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.

D. Testing safety and precautions:

1. Safety practices shall include the following requirements:

a. Applicable State and Local safety operating procedures.

b. OSHA.

c. NSC.

d. NFPA 70E.

2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.

E. Calibration of test equipment:

1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.

2. Instruments shall be calibrated in accordance with the following frequency schedule:

a. Field instruments: Analog, 6-months maximum; Digital, 12-months maximum.

b. Laboratory instruments: 12-months.

c. Leased specialty equipment: 12-months where accuracy is guaranteed by lessor.

3. Dated calibration labels shall be visible on test equipment.

4. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
6. Calibration standards shall be of higher accuracy than instrument tested.
7. Equipment used for field testing shall be more accurate than instrument being tested.

F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.

G. Notify Owner and Engineer one week in advance of any testing.

H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.

J. Include all test results in the maintenance manuals.

3.06 CLEANING

A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.07 PROJECT CLOSEOUT

A. Training:

1. At the time of completion, a period of not less than 4-hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 4-hour training is in addition to any instruction time called out in the Specifications for specific systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer’s Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.
2. All training sessions shall be video recorded. Confirm file type, i.e. MOV, AVI, MP4, etc. with the district. Each specification section that requires training shall include one file, and all Division 26 specifications shall be stored on a flash drive (USB3.0, 1TB min.) 3 flash drives shall be provided to the district representative with closeout documentation.

B. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.

C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION

SECTION 26 00 90

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor and equipment necessary to complete the demolition required for the item specified under this Division, including but not limited to:

1. Electrical demolition

1.02 SYSTEM DESCRIPTION

A. Disconnection, removal and relocation of all wiring, luminaires, outlets, conduit, and all other types of electrical equipment as described on Drawings.

B. Purpose is to remove, relocate and extend existing installations to accommodate new construction.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment necessary for patching and extending Work, as specified in other Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly review conditions in the area of demolition prior to commencing Work to ensure complete understanding of existing installation in relationship to demolition Work.

3.02 GENERAL REQUIREMENTS

A. Remove all wiring, luminaires, outlets, conduit, and all other types of electrical equipment indicated to be removed. Devices that are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings that are to remain, blank coverplates are to be installed on outlet boxes.

B. Where remodeling interferes with circuits in areas that are otherwise undisturbed, circuits shall be reworked as required.

C. Existing devices and circuiting that are indicated are indicated only for informational purposes. Contractor shall visit the Project site and shall verify conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all Work with that of other trades.

D. All equipment, luminaires, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the Project site.

E. Cutting and patching necessary for the removal of Electrical Work shall be included.

F. Remove and replace luminaires, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.

3.03 LUMINAIRES

A. Disconnect and remove abandoned luminaires. Remove conduits, wiring, boxes, brackets, stems, hangers, and other accessories.

3.04 OUTLETS

A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

3.05 CONDUIT

A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

3.06 WIRING

A. Removed abandoned wiring to source of supply.

3.07 EXISTING SYSTEMS

A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 24-hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.

3.08 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that shall remain.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaries: Remove lenses and lamps and clean all exposed surfaces. Also clean the lenses or replace if discolored. Provide all new lamping when re-assembling.

END OF SECTION

SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Building wire.
2. Cable.
3. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 4;	Armored Cable.
UL 44;	Thermoset-Insulated Wires and Cables.
UL 62;	Flexible Cord and Fixture Wire.
UL 83;	Thermoplastic-Insulated Wires and Cables.
UL 183;	Manufactured Wiring Systems.
UL 310;	Electrical Quick-Connect Terminals.
UL 486A & B;	Wire Connectors.
UL 486C;	Splicing Wire Connectors.
UL 486D;	Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
UL 493;	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
UL 510;	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
UL 854;	Service-Entrance Cables.
UL 1569;	Metal-Clad Cables.
UL 1581;	Reference Standard for Electrical Wires, Cables and Flexible Cords.
UL 2196;	Standard for Tests of Fire Resistive Cables.

2. National Electrical Manufacturer Association (NEMA):

   NEMA WC-70; Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.

3. Institute of Electrical and Electronic Engineers (IEEE):

   IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

   IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.
4. Final test results.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Building wire:
   a. Cerrowire
   b. General Cable
   c. Southwire Company
   d. Stabiloy (aluminum only)
   e. United Wire and Cable
2. Flexible cords and cables:

a. Carol Cable Company

b. Cerrowire

c. PWC Corp

3. Wiring connectors and terminations:

a. 3M Company.

b. Ideal.

c. Blackburn-Holub.

d. Burndy.

e. Thomas & Betts Corp.

f. Beau Barrier.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:

1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.

2. All building wire shall be stranded, unless otherwise indicated.

B. Insulation material:

1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.

2. Thermoplastic-insulated building wire.

3. Rubber-insulated building wire.

4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.

5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.

6. Feeders and branch circuits for direct-current (DC) in wet locations: Type XHHW-2.

7. Conductors for variable frequency drives (VFD): Type XHHW-2.

8. Service Entrance: Type RHW or THWN.

9. Control Circuits: Type THW or dual rated THHN/THWN.

10. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 FLEXIBLE CORDS AND CABLES (TYPE'S')

A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.

B. Type 'S' flexible cords and cables shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral component of the connector or as an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.04 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.

2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Compression type terminating lugs:

1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.

2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

D. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C.

E. Insulating putty:

1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.

2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.

F. Insulating resin:

1. Two-part liquid epoxy electrical insulating and encapsulating resin in a sealed mixing pouch, suitable for low-voltage power and control cable splices in wet locations, underground boxes, and vaults; rated for direct burial and continuous submersion; compatible with typical thermoplastic and thermoset cable insulations; provided as part of a molded splice kit or in manufacturer’s standard mixing bag. Use 3M Scotchcast electrical insulating resin and resin cable-joint kits listed for low-voltage wet-location splicing (e.g., 3M Scotchcast Resin Cable Joint Kits using Electrical Insulating Resin 40, or comparable current 3M product), or equal.

2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

G. Terminal strips:

1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.

2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.

3. Identify all terminals with numbering sequence being used for a system.

H. Crimp type connectors:

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support

2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.

3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.

4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

I. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

J. Wire lubricating compound:

1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.

2. Shall not be used on wire for isolated type electrical power systems.

K. Bolt termination hardware:

1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.

2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.

3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.

4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.

5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:

a. 1/4" bolt: 125amps

b. 5/16" bolt: 175amps

c. 3/8" bolt: 225amps

d. 1/2" bolt: 300amps

e. 5/8" bolt: 375amps

f. 3/4" bolt: 450amps

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75-degree C.

C. Feeders and branch circuits in dry locations shall be rated 90-degree C.

D. Feeders and branch circuits for direct-current (DC) systems, such as PV installations, in wet locations shall be type XHHW-2 copper conductors.

E. For wiring of the following, refer to the indicated Code Articles:

1. Fire pump systems shall comply with CEC Article 695.
2. Emergency systems shall comply with CEC Article 700.
3. Fire alarm systems shall comply with CEC Article 760.
4. Where the any above are required to be fire-resistive, refer to CEC Article 728.

F. Minimum conductor size:

1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

G. Color coding:

1. For 120/208volt, 3-phase, 4-wire systems:
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White
   e. Ground - Green
2. For 277/480volt, 3-phase, 4-wire systems:
   a. Phase A - Brown

b. Phase B - Orange

c. Phase C - Yellow

d. Neutral - Gray

e. Ground - Green

3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.

4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.03 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. 20amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208volt circuits located outside a 75-foot radius of panel source and for 277/480volt branch circuits located outside a 200-foot radius of panel source, unless otherwise noted.

F. 20amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208volt circuits located outside a 65-foot radius of panel source and for 277/480volt circuits located outside a 150-foot radius of panel source.

G. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.

K. Seal cable or wire, entering a building from underground or exiting walk-in cold box or freezer, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway in accordance with IEEE 576, Manufacturer's written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.

E. Wire pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

2. Use rope made of nonmetallic material for pulling feeders.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.

4. Pull in together multiple conductors or cables in a single conduit.

5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer's recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.

F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.05 MC CABLE INSTALLATION

A. Use of MC Cable is restricted to installation above accessible ceiling space, for lighting installed in the t-bar ceiling, i.e. fixture whips.

B. Install MC cable in accordance with Manufacturer's instructions and in strict accordance with CEC Article 330. Secure and support MC cable with straps, independent hanger wire per CEC 300.11 (B), or cable ties listed for the purpose. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly

secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.

C. Support cables every 6-feet and within 12-inches of boxes, per CEC Article 330, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

D. Hanger wire used to support suspended ceilings may not be used to directly support MC cables.

E. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

F. Bend the cable per CEC Article 330.

G. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.06 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.

F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.

K. Branch circuits (#10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.

2. The integral insulator shall have a skirt to completely cover the stripped wires.

3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

L. Feeder circuits: (#6 to 750 kCMIL)

1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination hardware assemblies:

1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
    a. 1/4" - 20 bolt at 80-inch pounds torque.
    b. 5/16" - 18 bolt at 180-inch pounds torque.
    c. 3/8" - 16 bolt at 20-foot pounds torque.
    d. 1/2" - 13 bolt at 40-foot pounds torque.Fp
    e. 5/8" - 11 bolt at 55-foot pounds torque.
    f. 3/4" - 10 bolt at 158-foot pounds torque.

3.07 IDENTIFICATION

A. Refer to Section 260553: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors' size #8 and larger using specified phase color markers and identification tags, with exception of the grounded conductor which must have a continuous white or gray jacket if #6 or smaller.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

E. In manholes, pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.08 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.

B. Prefunctional testing:

1. Visual and mechanical inspection:

a. Compare cable data with Contract Documents.

b. Inspect exposed sections of wires and cables for physical damage and proper connections.

c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.

d. Inspect compression applied connectors for correct cable match and indention.

e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.

f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.

g. Ensure wire and cable identification has been installed as specified herein.

2. Electrical testing:

a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:

1) 100% of all feeders 100amp rated and above.

2) 50% of all feeders smaller than 100amps.

3) 10% of all branch circuits at each individual panelboard.

b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.

c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.

d. Contractor shall furnish instruments, materials, and labor for these tests.

3. Test values: Investigate resistance values less than 50-megohms.

4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Power system grounding.
2. Site lighting grounding.
3. Electrical equipment and raceway grounding and bonding.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 05: Building Steel.
3. Division 22: Cold Water Piping.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 467;	Grounding and Bonding Equipment.

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE No. 142;	Recommended Practice for Grounding of industrial and Commercial Power Systems.
IEEE No. 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.

B. Ground each separately derived system neutral as described herein and indicated on Drawings.

C. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

D. Resistance:

1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.
2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Ground Rods:
   a. Weaver.
   b. Erico "Cadweld" Products, Inc.
2. Ground Wells:
   a. Christy Concrete Products, Inc.
   b. Forni Corp.
3. Ground Bushings, Connectors, Jumpers and Bus:
   a. O-Z/Gedney.
   b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.

B. General purpose insulated:

1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.

C. Bare conductors in direct contact with earth or encased in concrete: #4/0 AWG copper minimum, U.O.N.

D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.03 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.

2.04 GROUND WELL BOXES FOR GROUND RODS

A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".

2.05 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.06 CONNECTIONS TO PIPE

A. For cable to pipe: UL and CEC approved bolted connection.

2.07 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.

1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.

2.08 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by Code, indicated on the Drawing, and specified herein.

2.09 BUILDING GROUND BUS REQUIREMENTS

A. Main building power system ground bus:

1. Provide one 24" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in main electrical room utilizing insulating stand-offs at 18" above finished floor.

2. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer, and Belleville washer. Torque all lug connections.

3. All holes shall be drilled and tapped for single-hole lugs. Provide 6 spare lugs and lug spaces.

B. Building power system reference ground bus:

1. The reference ground bus is furnished as part of the main electrical switchboard for the building, along with neutral disconnect and bus, and is in addition to the main building power system ground bus outlined above. The building grounding electrode shall make a direct connection to the building referenced ground bus in the main switchboard.

2. Provide a #4/0 AWG copper ground conductor connection between the building reference ground bus in switchboard and the main building ground bus wall mounted in main electrical room.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Grounding electrodes:

1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10-feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per CEC Article 250. Electrode connection should be accessible.

2. Concrete encased grounding electrode (UFER ground): Provide a #4/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.

3. Supplementary grounding electrode (ground ring, grid and driven rods): Provide, as indicated on the Drawings, driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod with structural steel and adjacent rods with minimum #2 AWG bare copper conductor. Ground rod shall not be less than 10 foot from any other electrode of another electrical system or from adjacent ground rod(s).

B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.

C. Power system grounding:

1. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in the main electrical room. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:
    a. Grounding conductor from building reference ground bus in main service switchboard.
    b. Bonding conductor to metallic cold-water piping system.
    c. Bonding conductor to building structural steel.
    d. Separately derived system grounding conductors in same room.
2. At the building power system reference ground bus in the main service switchboard, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.

D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
2. Transformers: Provide copper terminal bar for grounding and bonding the transformer in accordance with CEC Articles 250.30 and 450.10. Bond the terminal bar to the enclosure and connect the following to the terminal bar:
    a. Primary feeder equipment ground conductor(s).
    b. Secondary feeder supply-side bonding jumper(s).
    c. Grounding electrode conductor.
    d. Main bonding jumper to neutral (when present).
    e. Supplemental grounding electrodes.

E. Equipment bonding/grounding:
1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
2. Provide a separate grounding bus at panelboards, switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.

F. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

3.03 FIELD QUALITY CONTROL

A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.

B. Prefunctional testing:

1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.

2. Visual and mechanical inspection:

   a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial, or concealment.

   b. Check tightness and welds of all ground conductor terminations.

   c. Verify installation complies with the intent of the Contract Documents

3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.

4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION

SECTION 260529

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Conduit supports.
2. Equipment supports.
3. Fastening hardware.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 03: Cast-in-place concrete. Concrete equipment pads.
3. Division 05: Miscellaneous metals. Hangers for electrical equipment.
4. Division 09: Ceiling suspension systems. Slack support wires.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.03 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Concrete fasteners:
    a. Hilti “Kwik-Bolt TZ2”.
    b. Phillips "Red-Head".
    c. Remington.
    d. Ramset.
2. Concrete inserts and construction channel:
    a. Unistrut Corp.
    b. GS Metals "Globe Strut."
    c. Thomas & Betts "Kindorf" Corp.
3. Conduit straps:
    a. O-Z/Gedney.
    b. Erico "Caddy" Fastening Products.
    c. Thomas & Betts "Kindorf" Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONCRETE FASTENERS

A. Provide expansion-shield type concrete anchors.

B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.03 CONCRETE INSERTS

A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.04 THREADED ROD

A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.05 CONSTRUCTION CHANNEL

A. Provide 1.5-inch by 1.5-inch, 12-gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.06 CONDUIT STRAPS

A. One-hole and two-hole strap, steel, or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.

1. Use malleable strap with spacers for exterior and wet locations.

2. Use steel strap without spacers for interior locations.

B. Steel channel conduit strap for support from construction channel.

C. Steel conduit hanger for pendant support with threaded rod

D. Steel wire conduit support strap for support from independent #12-gauge hanger wires.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate size, shape, and location of concrete pads with Division 03, Cast-in-place concrete.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.03 INSTALLATION

A. Furnish and install supporting devices as noted throughout Division 26.

B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet, and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.

J. Fabricate supports from structural steel or steel channel, rigidly welded, or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

M. Two-hole conduit strap shall be furnished and installed near and attached to HVAC equipment. Fasteners shall be nut secured. Bolt close tightening clamps and vertical style are prohibited at HVAC equipment.

3.04 ERECTION OF METAL SUPPORTS

A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

3.06 ANCHORAGE

A. All floor mounted, free standing electrical equipment such as transformers, switchboards, distribution boards, etc. shall be securely fastened to the floor structure.

B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 260010: Basic Electrical Requirements.

END OF SECTION

SECTION 260531

CONDUIT

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Rigid steel conduit and fittings.
2. PVC insulated rigid steel conduit and fittings.
3. Intermediate metal conduit and fittings.
4. Electrical metallic tubing and fittings.
5. Flexible metallic conduit and fittings.
6. Liquidtight flexible metallic conduit and fittings.
7. Miscellaneous conduit fittings and products.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 01: Cutting and patching.
3. Division 07: Sheet metal flashing and trim.
4. Division 09: Painting. Exposed conduit and other devices.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. American National Standards Institute, Inc. (ANSI):

ANSI C80.1;	Rigid Steel Conduit, Zinc-Coated.
ANSI C80.3;	Electrical Metallic Tubing, Zinc Coated.
ANSI C80.5;	Rigid Aluminum Conduit.
ANSI/ TIA-569-D	Telecommunications Pathways and Spaces.

2. Underwriters Laboratories, Inc. (UL):

UL 1;	Flexible Metal Conduit.
UL 6;	Rigid Metal Conduit.
UL 360;	Liquid-Tight Flexible Steel Conduit.

UL 514B; Conduit, Tubing and Cable Fittings.

UL 635; Insulating Bushings.

UL 797; Electrical Metallic Tubing - Steel.

UL 1242; Intermediate Metal Conduit - Steel.

3. National Electrical Manufacturer Association (NEMA):

NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools, or specific installation techniques.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
   a. Allied Tube and Conduit Co.
   b. Triangle PWC, Inc.
   c. Western Tube and Conduit Corp.
   d. Spring City Electrical Manufacturing Co.
   e. Alflex Corp.
   f. American Flexible Metal Conduit Co.
   g. Anaconda.
2. Fittings:
   a. Appleton Electric Co.
   b. OZ/Gedney.

c. Thomas & Betts Corp.

d. Spring City Electrical Manufacturing Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure; provide two locknuts at each box or can, inside and outside.

C. Three-piece couplings: Hot dip galvanized, cast malleable iron.

D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150-degree C minimum.

E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150-degrees C.

G. All fittings and connectors shall be threaded.

2.03 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.

B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.

B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

B. Set screw type couplings: Hot dip galvanized, steel, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.

C. Set screw type connectors: Hot dip galvanized, steel, UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.

D. Raintight couplings: Hot dip galvanized, steel; UL listed raintight and concrete tight, using gland and ring compression type construction.

E. Raintight connectors: Hot dip galvanized, steel, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.06 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for luminaire connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

E. Fire rated penetration seals:

1. UL building materials directory classified.

2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.

3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet, or wrap/strip.

F. Standard products not herein specified:

1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

G. Hazardous area fittings: UL listed for the application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. Galvanized rigid steel conduit (GRS) can be used in the following applications:
1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.
3. For use where conduit is subject to physical damage.
4. For feeders and branch circuits installed exposed on the roof.

B. PVC insulated galvanized rigid steel conduit can be used in the following applications:
1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
2. Use 20- or 40-mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
3. Use 20- or 40-mil for runs beneath floor slabs on grade.
4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

C. Intermediate metal conduit (IMC): Can be used for the same application as galvanized rigid steel conduit as specified herein, except for hazardous locations prohibited by CEC or Local Codes.

D. Electrical metallic tubing (EMT): Can be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 8 feet above the finish floor except within electrical, communication or signal rooms or closets (subject to physical damage).

E. Flexible metallic conduit (FMC): Can be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers,

solenoid valves, float and flow switches or similar devices and to luminaires installed in suspended ceilings.

F. Liquidtight flexible metallic conduit (LFMC): Can be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc.

G. Fire-Resistive Systems: Refer to CEC Article 728. All devices utilized, mountings, and supports shall be listed as part of the fire-resistive system.

3.03 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.

D. Conduits shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Communications conduits shall not be placed closer than 12 inches to power, a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

F. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

G. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

H. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.

I. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.

J. Connect recessed luminaires to conduit runs with maximum six feet of flexible metal conduit.

3.04 INSTALLATION

A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 3/4" for interior applications and 1" for exterior and underground applications.

C. Minimum Communication and Signal Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1" for interior applications and 2" for exterior and underground applications.

D. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.

E. All communication and signal conduit sizes indicated on the Drawings are sized for 40% fill or less for category 6 or 6A cable. If cable type or size is changed the Contractor shall be responsible for resizing conduits upward to meet a maximum 40% fill.

F. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.

G. Conduit connections to motors and surface cabinets shall be concealed, except for electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.

H. Install conduits in complete runs before pulling in cables or wires.

I. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

J. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

K. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.

L. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

M. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.

N. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.

O. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

P. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

Q. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360-degrees, total).

R. A run of communications and signal conduit between terminations at wire pulling points shall not contain more than the equivalent of two quarter bends (180-degrees, total).

S. Emergency power raceway system: Install entirely independent of other raceway systems, except where specifically allowed by CEC Article 517.

3.05 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:

1. Where indicated on the Structural Drawings.

2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.

B. Cutting or holes:

1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.

2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.

3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.

4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.

C. Sealing:

1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.

2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.

1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.

2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.

3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.

4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.06 CONCEALED IN CONCRETE

A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.

B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.

C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.

E. Make couplings and connections watertight.

F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.07 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.

F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets, or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.

G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms: water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects, and rodents. Install raceway sealing foam at the following points:

1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
2. Where conduits enter buildings from below grade.

H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:

1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease, or water. Provide a green ground wire with FMC or LFMC conduit.

3.08 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in accordance with the Manufacturers written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous locations.
2. At luminaires, switches, receptacles and as required by the CEC.

3.09 SUPPORTS

A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:

1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. After concrete installation:

a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8” embedment.

b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.

c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 26 05 33

BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Wall and ceiling outlet boxes.

2. Pull and junction boxes.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

2. Division 08: Access doors. Wall and ceiling access doors.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. American National Standards Institute/National Electrical Manufacturer Association:

ANSI/NEMA OS-1;	Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
ANSI/NEMA OS-2;	Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
NEMA 250;	Enclosures for Electrical Equipment (1000 volts maximum).

2. Underwriters Laboratories (UL):

UL 50;	Enclosures for Electrical Equipment.
UL 514A;	Metallic Outlet Boxes.
UL 1773;	Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Outlet and junction boxes:
    a. Spring City Electrical Manufacturing Co.
    b. Thomas & Betts Corp.
    c. Raco, Inc.
2. Cast boxes:
    a. Appleton Electric Co.
    b. Crouse-Hinds.
3. Floor boxes:
    a. Legrand.
    b. Hubbell Inc.
    c. Raceway Components, Inc.
4. Pullboxes:
    a. Circle AW Products.
    b. Hoffman Engineering Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

A. Standard outlet box:

1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
2. 4-inch square by 2-1/8-inch deep shall be minimum box size.
3. ANSI/NEMA OS 1.

B. Concrete box:

1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
2. Select height as necessary to position knockouts above concrete reinforcing steel.
3. ANSI/NEMA OS 1.

C. Tile box:

1. Provide outlet boxes for installation in tile or concrete block walls.

2. Standard outlet boxes with raised, square corners and device covers are acceptable.

3. ANSI/NEMA OS 1.

D. Cast metal outlet body:

1. Provide 4-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.

2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

E. Conduit outlet body: Provide malleable iron, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

A. Sheet metal pull and junction box:

1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.

2. ANSI/NEMA OS 1.

B. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

2.04 FLOOR BOXES

A. Refer to Section 262726: Wiring Devices for floor mounted service boxes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.

B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.

C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.

E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed luminaires.

F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.

G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.

E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

G. Welded outlet boxes shall only be used in concealed interior installations.

H. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.

I. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.

J. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

K. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

L. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

M. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.

N. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.04 SUPPORTS

A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.

B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.

C. Support boxes independently of conduit system.

D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.

E. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION

ECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Electrical equipment nameplates.
2. Panelboard directories.
3. Wire and cable identification.
4. Buried electrical line warnings.
5. Junction box identification.
6. Warning and caution signs.
7. Inscribed device coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 09: Painting.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein.
2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Conduit and wire markers:
   a. Thomas & Betts Corp.
   b. Brady.
   c. Griffolyn.

2. Inscription Tape:

a. Kroy.

b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.03 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.04 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener.

B. Dimensions: 2" diameter 19 gauge.

2.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers (85-168), etc.

2.06 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.

B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.07 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.08 UNDERGROUND CONDUIT MARKER

A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.09 INSCRIBED DEVICE COVERPLATES

A. Coverplate material shall be as specified in Section 262726: Wiring Devices.

B. Methods of inscription: (Unless otherwise noted)

1. Type-on-tape:

a. Imprinted or thermal transfer characters onto tape lettering system.

b. Tape trimmer.

c. Matte finish spray-on clear coating.

2. Engraving:

a. 1/8" high letters.

b. Paint filled letters finished in black.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

A. Installation:

1. Degrease and clean surfaces to receive nameplates.

2. Install nameplates parallel to equipment lines.

3. Secure nameplates to equipment fronts using machine screws.

B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:

1. Equipment or device designation:

a. Equipment designations shall conform to the following:

1) Building number designation – 1.

2) Power source:

a) Normal - __

b) Emergency – E

3) Equipment description:

a) Main switchboard – MS

b) 277/480volt distribution board – HD

c) 277/480volt panelboard – H

d) 120/208volt distribution board – LD

e) 120/208volt panelboard – L

f) Transformer – TX

4) Floor number where equipment is located – 03

5) Equipment designation – B

b. Example: 2EHD03A

1) Building number 2.

2) Emergency source.

3) 277/480volt distribution board.

4) Floor level 03.

5) Board designation A

2. Amperage, KVA or horsepower rating, where applicable.

3. Voltage or signal system name.

4. Source of power or control.

5. Examples:

a. Boards: 2EHD03A; 1200A, 277/480volt, 3-phase, 4-wire; Served from 2EATS03A

b. Transformers: 2ETX03A; 150KVA, 480volt primary, 120/208volt, 3-phase, 4-wire secondary; Served from 2EHD03A; Load Served: 2EL03A

c. Disconnects or Individual Motor Starters: EF-1; 20HP; 480volt, 3-phase,3-wire; Served from 2EHD03A

C. Nameplates for power system distribution equipment and devices are to be black.

D. Nameplates for signal systems equipment and devices are to be black except as follows:

1. Fire alarm and life safety - Red.

E. Minimum letter height shall be as follows:

1. For panelboards, switchboards, battery panels, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.

2. For individual circuit breakers, switches and motor starters in panelboards, distribution boards, and switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.

3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.

4. For transformers use ½-inch letters to identify equipment designation. Use ¼-inch letters to identify primary and secondary voltages, etc.

5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

A. Provide panel-mounted operators devices such as pilot lights, reset buttons, “HAND-OFF-AUTO” switches, etc.

3.04 BRASS TAGS

A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.

B. Provide tags for all feeder cables in underground vaults and pull boxes.

C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.05 PANELBOARD DIRECTORIES (400AMP OR LESS)

A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.

B. Verify room numbers or area designation with Project Manager.

C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.06 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.

B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.07 UNDERGROUND CONDUIT MARKERS

A. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.08 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.09 WARNING, CAUTION, AND INSTRUCTION SIGNS

A. Provide warning, caution or instruction signs where required by CEC, where indicated or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding or other emergency operations.

C. Elevator Machine Rooms(s): Provide warning sign for each elevator controller disconnect to read "Warning - Part of the Control Panel is not De-energized by this Switch."

D. Elevator car light and fan switch: Provide signage indicating elevator number serving and function of each switch.

3.10 INSCRIBED DEVICE COVERPLATE

A. General:

1. Lettering type: Helvetica, 12 point or 1/8" high.
2. Color of characters shall be black.
3. Locate the top of the inscription ½” below the top edge of the coverplate.
4. Inscription shall be centered and square with coverplate.

B. Application:

1. Type-on-tape inscriptions shall be provided for the following devices:
   a. Receptacles.
   b. Outlets in surface raceways.
   c. Telecommunication outlets.
2. Engraved inscriptions shall be provided for the following devices:
   a. Multi-ganged switches.
   b. Special purpose switches.
3. Type-on-tape installation:
   a. Tape shall be trimmed to the height of the letters.
   b. Trim tape length to ¼-inch back from each edge of coverplate.
   c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION

SECTION 26 09 42

DIGITAL LIGHTING CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Lighting control modules.
2. Control stations.
3. Occupancy sensors.
4. Daylight sensors.
5. Network communication cabling.
6. Startup and field quality control.
7. Commissioning.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 25 – Building Automation System (BAS): Lighting control interface.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. National Electrical Manufacturer Association (NEMA):

NEMA 250;	Enclosures for Electrical Equipment.
NEMA ICS 1;	Industrial Control and Systems.
NEMA ICS 4;	Terminal Blocks and Industrial use.
NEMA ICS 6;	Enclosures for Industrial Controls and Systems.

2. Underwriters Laboratories, Inc. (UL):

UL 50;	Cabinets and Boxes.
UL 773A;	Nonindustrial Photoelectric Switches for Lighting Control.
UL 916;	Energy Management.
UL 924	Standard for emergency lighting and power equipment.

UL1008 Transfer switch equipment.

1.03 SYSTEM DESCRIPTION

A. A standalone digital lighting control system that interconnects and lighting components such as occupancy and daylight sensors, control stations, etc. to control luminaires connected to the system. All components are locally connected and function independently of any central control software.

B. Control of luminaries will come from distributed control modules capable of “ON/OFF” control and 0-10volt dimming. The system shall be capable of dimming other loads such as electronic low voltage (ELV) and magnetic low voltage (MLV).

C. The lighting control components shall be capable of adjusting their specific parameters such as dimming presets, time delays, etc. per the device type. Handheld or computer-based commissioning tools shall be available during startup to reduce the time required at startup and commissioning. These tools shall be available to the Owner after startup and commissioning.

D. The control system is connected independent of electrical lighting circuits.

E. The system shall utilize either hardwired or wireless components.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. Describe system operation, equipment and dimensions and indicate features of each component.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

5. Submit Manufacturer's installation instructions.

6. Complete bill of materials listing all components.

7. Warranty.

1.05 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements to include the following:

1. Operation and maintenance manuals shall include the following:

a. A detailed explanation of the operation of the system.

b. Instructions for routine maintenance.

c. Pictorial parts list and part numbers.

2. Telephone numbers for the authorized parts and service distributors.

3. Final testing report.

1.06 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Digital lighting control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.08 WARRANTY

A. Units and components offered under this Section shall be covered by a minimum *2*-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Network addressable lighting control system:

a. Acuity “nLight” and/or “nLight Air”

b. Wattstopper Plus wired and/or wireless.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. The lighting control system shall be standalone with no central control software. Lighting components shall tie together and communicate directly with each other as required for the device type.

B. Control stations, occupancy sensors, and daylight sensors shall tie into dimming and relay modules to control luminaires.

C. The control parameters shall be set within each device, either as dip switches or dials on the device itself or with handheld or computer-based commissioning tools. The parameters remain set until they are manually changed.

D. Daylight sensors shall rationalize changes to light levels when daylight is available and shall maintain a steady light level when subjected to fluctuating ambient conditions.

E. Where required in a sequence of operation an astronomical time clock function shall be integrated into the control modules or relay panels.

F. During an emergency condition (loss of normal power), the system shall not impede the emergency lighting to function properly, i.e. the control system shall control emergency lighting to turn on at full light output and lock out user controls.

G. The control system shall allow occupancy sensor, when relaying a vacant status to either turn lights off or dim lights to a preset level.

H. The control system components shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission.

2.03 LIGHTING CONTROL MODULES

A. General:

1. Lighting control modules provide an interface between the control system and luminaires. Modules take inputs from the system and convert the commands through the power and control wiring to the fixture providing “ON/OFF/DIMMING” functions.

2. Lighting control modules contain a 16amp minimum rated relay(s) for “ON/OFF” control as well as a 0-10volt dimming signal. Modules shall also have the capability of two wire phase dimming (MLV or ELV).

3. In the event of a power failure, control modules connected to luminaires shall default to the “on” state at full light output.

B. The following lighting control modules shall be available with the system, at a minimum:

1. Single zone 0-10volt control module with a relay.

2. Multi-zone 0-10volt control module with one relay per 0-10volt zone (“Room Controller”).

3. Single zone two wire dimming module (Incandescent, MLV, or ELV) with a relay.

4. Multi-zone two wire dimming module (Incandescent, MLB, or ELV with one relay per zone (“Room controller”)

C. Mounting:

1. Single zone modules shall have a ½” nipple to mount directly to a ½” knockout on a junction box.

2. Multi-zone modules shall mount stand alone or onto a 4 square junction box.

2.04 CONTROL STATIONS

A. General:

1. The controllers are configurable wall mounted devices that provide local “ON/OFF/DIMMING” control to lighting zones.

2. Each device can be set-up and modified through the control systems software interface.

B. Dimmer switch controller:

1. Software configurable dimmer switch that provides “ON/OFF” switching and the capability to dim.
2. Dimming to be continuous over the full range of the driver or ballast it is controlling.

C. Dimming scene controller:

1. Multi-button controller allowing the end user to recall zones or scenes for “ON/OFF/DIMMING” control.
2. Scenes are made up of multiple zones, where each zone is dimmed to a specific light output.
3. Scene configuration can be changed via control systems software.
4. The scene controller shall also allow for a custom labeling feature that allows scene labels on the controller to be easily modified.

D. Specifics:

1. Mounting:
   a. Controllers utilize a standard single-gang device strap configuration for ease in mounting. Where multiple controllers are ganged together, they shall allow for a single multi-gang cover plat to be used.
   b. Mounts to standard switch box or cut-in ring.
2. Controllers shall tie to the system in one of the following ways:
   a. Hardwired low voltage, wiring and connections per manufacturer’s requirements.
   b. Wireless with line-power connection. Use of devices that require batteries are prohibited.. Mechanically triggered wireless switches shall not be allowed unless approved by The Owner.

2.05 OCCUPANCY SENSOR

A. General:

1. Occupancy sensors shall automatically detect movement within a space, reporting the state of occupancy to the control modules for “ON/OFF/DIMMING” control of lighting zones and “ON/OFF” control of the controlled receptacle circuits within that space.
2. All setpoints for the occupancy sensor shall be accessible on the device or through the commissioning tool.
3. Sensors shall capable of being linked together via hard wired connections to provide a larger coverage area.
4. Provide enough occupancy sensors as required for complete area coverage they are installed in, regardless of how many sensors are shown on the Drawings.

B. Specifics:

1. Sensor shall have a coverage of 1,000 square feet. Manufacturer to provide additional sensors if coverage is less than 1,000 square feet.
2. Sensors shall be infrared or dual technology or microphonic. Dual technology sensors shall be capable of disabling either infrared or ultrasonic sensing.

2.06 DAYLIGHT SENSOR

A. General:

1. Daylight sensors shall automatically measure the amount of ambient light within a space, reporting the state of occupancy to the control modules for “ON/OFF/DIMMING” control of lighting zones.
2. Setpoints for the sensors shall be adjusted directly on the device or through commissioning tool. The setpoints refer to the range at which electric lighting will dim in response to the amount of light the sensor detects.
3. Daylight sensors shall continuously monitor the ambient light level.
4. Interior daylight sensors shall operate on a “closed loop” protocol, measuring both daylight and electric light contributions.
5. Exterior daylight sensors shall operate on an “open loop” protocol, measuring only daylight contributions.

B. Specifics:

1. Sensor shall mount directly to any surface, no junction box required.
2. Integrated sensors on luminaires shall be installed at the lighting manufacturer’s factory.
3. Sensors shall tie to the system in one of the following ways:
    a. Hardwired low voltage, wiring and connections per manufacturer’s requirements.
    b. Wireless with line-power connection. Use of devices that require batteries is prohibited.
4. Exterior sensors shall be outdoor rated.

2.07 DEVICE COMMUNICATION CABLING

A. General:

1. The device communication cabling integrates devices such as occupancy sensors, photocell sensors, control modules and control stations with each other to provide a complete standalone system.
2. The network communication cabling provides low-voltage power to all devices on the network, eliminating the need for external power supplies and power packs for devices such as occupancy sensors. Where a device requires 120volt power it shall be noted on the submittal.
3. Cabling shall be topology free.
4. Cabling shall be plenum rated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of low-voltage lighting control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install the addressable lighting control system in accordance with the Manufacturer's written instructions, as indicated on the drawings and as specified herein.

B. Locate relay panel(s) where indicated on the plans.

C. All interior luminaires shall be controlled via the control system unless otherwise noted on the plans. Refer to the drawing symbols list for the differentiation between networked luminaire devices and standalone devices.

3.03 ATTIC STOCK

A. Spare Parts: Provide spare parts totaling 5 percent of the quantity specified, or two total, whichever is greater, of the following:

1. Control Modules (provide for each type used on the project):
2. Occupancy Sensors:
3. Daylight Sensors:
4. Dimmer Switches (provide for each type used on the project):

3.04 OCCUPANCY SENSOR

A. Occupancy sensors shall be placed in a location that provides maximum coverage and minimizes false positives such as being triggered through an open door.

B. Refer to the architectural RCPs and locate sensors as shown or if not shown, locate in line with other ceiling devices while still maximizing area coverage.

C. Where the coverage of a sensor is inadequate for the space it is being installed in, the manufacturer shall provide additional sensors for the contractor to install. The cost of these sensors and installation shall be included at the time of bid.

3.05 DAYLIGHT SENSORS

A. Locate daylight sensors per the manufacturer’s requirements in order to provide accurate electric and daylight light levels.

B. Coordinate the final location of the sensor with other devices in the area.

3.06 CONTROL MODULES

A. Install all control modules per the shop drawings and manufacturer’s requirements. Ensure devices are in an accessible location. Avoid locations where the devices are visible to the public.

3.07 AUXILIARY DEVICES

A. Where devices, not covered under these Division 26 specifications, are required to provide a complete lighting control system, furnish and install such devices per the manufacturer’s instructions.

3.08 STARTUP AND FIELD QUALITY CONTROL

A. General:

1. All work related to the startup of the addressable lighting control system shall be by a factory-authorized agent of the Manufacturer of the system along with the assistance of the electrical contractor.

2. All programming, testing, trouble shooting, etc. shall be included in this contract.

B. Prefunctional resting:

1. Visual and mechanical inspection:

a. Inspect for physical damage, defects alignment and fit.

b. Perform mechanical operational tests in accordance with Manufacturer's instructions.

c. Compare nameplate information and connections to Contract Documents.

d. Check tightness of all control and power connections.

e. Check that all covers, barriers, and doors are secure.

2. Contractor shall provide all necessary programming assistance to set up and program the lighting control parameters.

3. Electrical tests:

a. The system shall be completely tested in accordance with operational parameters, tolerances, and Manufacturer's instructions. Any problem shall be documented and corrected.

b. Test all control circuits and verify proper operation of all lighting circuits throughout the control system.

c. Ensure the lighting zone controls match that of the Contract Documents.

d. Verify the proper integration with the mechanical control system for override control and monitoring of low-voltage lighting control system.

e. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.

C. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

D. Contractor shall submit the testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.09 COMMISSIONING

A. General:

1. Once startup of the system is complete and no defects to the system are detected the commissioning process shall begin; furthermore, it is acceptable to program the system per the commissioning requirements during the startup phase.

2. All work related to the commissioning of the digital lighting controls shall be by the electrical contractor or by a factory-authorized agent of the Manufacturer of the system.

3. At least three weeks prior to any commissioning verification, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

4. Refer to the Lighting Control Sequence of Operation on the Drawings.

B. Occupancy sensors:

1. All occupancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.

2. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to 15 minutes.

C. Daylight sensors:

1. Where no direction is provided in a sequence of operation or by the owner, the daylight sensor setpoint to dim the electric light should be at 150% of the maximum electric light output.

D. Scene controllers:

1. Where no scenes have been described in a sequence of operation or by the owner the contractor shall provide the following scenes as appropriate for the space:

a. Scene 1: All luminaires on at 100%

b. Scene 2: Luminaires near screen displays off, all other luminaires on at 75%.

c. Scene 3: All indirect luminaires off, all direct luminaires on at 100%.

d. Scene 4: All direct luminaires off, all indirect luminaires on at 100%.

e. Scene 5: All luminaires off.

E. Time schedules:

1. All time schedules required shall be done through an astronomical time clock integral to the devices and equipment. The building location and date shall be programmed to ensure proper time schedule functions.

2. If no sequence of operations is provided program time schedules as follows:

a. Interior spaces: Per owner’s direction, do not assume hours of operation.

b. Exterior spaces: on 30 minutes before sunset, and off 30 minutes after sunrise.

F. Third party commissioning:

1. Refer to Specification Section 260800: Electrical Commissioning.

2. The purpose of third-party commissioning shall be to verify the system’s functionality and parameters as detailed on the Drawings and specifications. The contractor and factory agent are still responsible for performing the startup and commissioning of the system.

G. Contractor shall be responsible for all acceptance testing requirements related to the lighting control system as outlined in the California Energy Code Title 24 Part 6.

3.10 TRAINING

A. Refer to Specification Section 260800: Electrical Commissioning.

B. Factory authorized service representative shall conduct a 1-hour training session for Owner's Representatives upon completion and acceptance of system. Instruction shall include operation, programming, and maintenance of equipment.

C. Any special commissioning / configuration tools required to program the lighting control system shall be provided to the district representative upon completion of training.

D. Contractor shall schedule training with a minimum of 7 days advanced notice.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Branch circuit panelboards.

2. Distribution panelboards (400amps to 800amps).

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. National Electrical Manufacturers Association (NEMA):

NEMA AB 1;	Molded Case Circuit Breakers.
NEMA PB 1;	Panelboards.
NEMA PB 1.1;	General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

2. Underwriters Laboratories, Inc. (UL):

UL 67;	Panelboards.
UL 486E;	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
UL 489;	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
UL 870;	Wireways, Auxiliary Gutters and Associated Fittings.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards

2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contactors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
4. Furnish structural calculations for equipment anchorage as described in Section 26 00 10: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete bill of material listing all components.
7. Warranty.

B. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The Contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the Engineer prior to release of order.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and parts number.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Panelboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PB1.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.08 EXTRA MATERIAL

A. Turn over two (2) sets of panelboard keys to the Owner at completion of Project. All panelboards shall be keyed alike.

B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Square D.
2. ABB/ General Electric.
3. Eaton.
4. Siemens.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 PANELBOARDS - GENERAL

A. Enclosure:

1. Cabinets shall be NEMA Type 1 enclosure, door, and trim of code gauge galvanized steel. Provide NEMA Type 3R enclosures for exterior mounted panelboard.
2. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
3. Provide combination spring catch and lock on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.

B. Bus assembly and terminations:

1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices
2. Cross connectors shall be copper, drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.
3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.
4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder.

5. Refer to panelboard schedules on Drawings for bus rating. Bus rating shall match or be greater than main device or main lug rating.
6. As a minimum, bus bars shall be rated 10,000 AIC for 120/208volt panelboards and 14,000 AIC for 277/480volt panelboards. Unless otherwise noted.
7. Provide full sized bussing in all sections of multi-section panelboards.
8. Termination Lugs: Rated for use with aluminum/copper conductors.
9. All "SPACES" shall be ready for installation of future overcurrent protective device.

C. Miscellaneous requirements:

1. Circuit numbering: Starting at the top, indicate odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers. Provide metal embossed circuit identification of panelboards.
2. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of Work. Directory shall be typewritten denoting loads served by room number or area for each circuit.
3. Nameplates: Provide engraved nameplate for each panelboard. See Section 260533: Electrical Identification for requirements.

D. Refer to Panelboard Schedules for the following:

1. Mounting style; service voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and breakers; quantity, poles and rating of overcurrent protective devices.

E. Overcurrent protective devices:

1. Refer to Section 26 28 16: Overcurrent Protection Devices.
2. Overcurrent protective devices shall be molded case circuit breakers.
3. Main devices shall be hard bus connected to the panelboard bus bars.
4. In all cases, panelboards fed directly from a transformer shall have a main overcurrent protective device. If not indicated on the Drawings or Panelboard Schedules, provide this device sized to provide the full capacity of the transformer rating.
5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the branch devices are NOT acceptable, i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.
6. Panelboards overcurrent protective devices layout shall conform to the layout indicated on the panelboard schedules.
7. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.

F. Surge Protective Devices:

1. Refer to Section 264313: Surge Protective Devices.

G. Finish: Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).

2.03 DISTRIBUTION PANELBOARDS

A. Enclosures shall be sized as required and shall meet the space restriction allocated on Drawings. Panelboard shall comply with NEMA PB 1.

B. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install cross connectors and mounting hardware to match the frame size ampere rated noted.

2.04 BRANCH CIRCUIT PANELBOARDS

A. Enclosure shall be 20" wide x 5-3/4" deep, surface or flush mounted and shall comply with NEMA PB 1.

B. Flush panelboards mounted adjacent to each other shall be same physical size.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install minimum 100amp branch circuit cross connectors and mounting hardware. For future device spaces larger than 100amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of panelboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Where panelboards are shown to be flush mounted in walls, the contractor shall insure that 6” deep studs are employed in wall construction to accommodate the 5-3/4” deep panelboard enclosure.

3.02 INSTALLATION

A. Install panelboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Set panels plumb and symmetrical with building lines in conformance with PB1.1. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.

C. Mounting height shall be 6 feet.

D. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

E. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.

F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

G. Replace panel pieces, doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

H. Conduits terminating in concentric, eccentric, or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.

I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.

J. Provide four 3/4" spare conduits stubbed-out of flush mounted panelboards to nearest accessible ceiling space.

K. Visually inspect panelboard for rust and corrosion. If signs of rust and corrosion are present, restore or replace panelboard to new condition.

L. In damp and wet locations, mount panelboards with a minimum one inch of air space between cabinet and the wall or other support material.

M. Provide close up plugs in all unused openings in the cabinet.

N. Field install handle ties on single pole circuit breakers that share a neutral conductor.

O. Circuit breakers feeding "Fire Alarm Control Panel(s)" shall be red in color.

3.03 FIELD QUALITY CONTROLS

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.

2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.

3. Prepare final test report including results, observations, failures, adjustments, and remedies.

4. Apply label on panelboards upon satisfactory completion of tests and results.

5. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

E. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.

2. Visual and mechanical inspection:

a. Inspect for physical damage, defects alignment and fit.

b. Perform mechanical operational tests in accordance with Manufacturer's instructions.

c. Compare nameplate information and connections to Contract Documents.

d. Check tightness of all power connections.

e. Check that all covers, barriers, and doors are secure.

3. Electrical tests:

a. Insulation resistance: 1000volt DC tests for one minute on all 600volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10-megohms resistance to ground shall be repaired or replaced.

b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.

c. Ground resistance: Test resistance to ground of system and equipment ground connection.

d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.

F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence, and the Engineer's hourly rate.

G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 CLEANING

A. Prior to energizing of panelboards, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of panelboards per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION

SECTION 26 27 19

SURFACE RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

1. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
    a. Surface metal raceways.
    b. Surface nonmetallic raceways.
    c. Multi-outlet assemblies.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. Federal Specifications (FS):

FS W-C-582;	Conduit, Raceway, Metal and Fitting; Surface.

2. Underwriters Laboratories, Inc. (UL):

UL 5;	Standard for Surface Metal Raceways and Fittings.
UL 5A	Nonmetallic Surface Raceways and Fittings.
UL 870;	Wireways, Auxiliary Gutters and Associated Fittings.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and proposed application.
3. Submit Manufacturer's installation: Provide written instructions for raceway products special installation techniques.
4. Complete bill of material listing all components.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Surface metal raceways and multi-outlet assemblies:

a. Wiremold (Legrand)

2. Surface nonmetallic raceways and multi-outlet assemblies:

a. Wiremold (Legrand)

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 SURFACE METAL RACEWAYS

A. Assembly: Single or Double compartment raceway shall be complete to include bases, covers, end plates, compartment divider, fittings and connections as required. Raceways shall be UL labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of cold rolled steel with 0.094" minimum wall thickness. or of extruded aluminum of No. 6063-T5 aluminum alloy extrusion. Corner extrusions shall be identical to linear extrusions.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Fittings: Boxes, extension rings, couplings, elbows, and connectors shall be designed for use with raceway system.

E. Finish: To be determined by the Architect.

F. Application: Utilize for power-only applications.

1. Legrand/Wiremold 500 or 700 series, or equal, as required.

2.03 SURFACE NONMETALLIC RACEWAYS

A. Assembly: Single, double, or triple compartment raceway shall be complete to include bases, covers, end plates, compartment divider, fittings and connections as required. Raceways shall be UL labeled. Double and triple compartment raceway shall have individual covers for each channel to allow access to one compartment at a time.

B. Construction: Raceway base, cover, compartment divider and end plates shall be of non-metallic construction.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Fittings: Boxes, extension rings, couplings, elbows and connectors shall be designed for use with raceway system.

E. Finish: To be determined by the Architect.

F. Application:

1. Multi-channel nonmetallic raceway system: Utilize for applications where both power and low voltage systems (telecommunications, A/V) are required.

a. Legrand/Wiremold 5500 or equal.

2. Single channel, non-metallic raceway shall not be used for power applications; acceptable for use only for low voltage systems.

2.04 MULTI-OUTLET ASSEMBLIES

A. Assembly: Single or Double compartment raceway shall be factory pre-assembled, pre-cut and complete, including bases, covers, end plates, compartment dividers, wiring, receptacles, fittings and connections as required. Raceway shall be U.L. labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of cold rolled steel with 0.094" minimum wall thickness.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Receptacles: Convenience receptacles mounted in cover shall be NEMA 5-20R in accordance with Specification Section 262726: Wiring Devices. Space receptacles on center as indicated on Drawings.

E. Coverplates: Device coverplates shall be of same material and finish as the raceway.

F. Wiring: Receptacle circuits shall be pre-wired, or field wired with minimum #12 AWG conductors throughout entire length of section. 12" pigtails shall be provided for field connections. Pigtails shall be properly tagged with circuit identification in the field. No tap splicing.

G. Wire retention clips: Shall be installed in sufficient numbers to securely hold all wire lengths in place.

H. Grounding: Ground continuity shall be maintained to receptacles throughout the entire length of raceway by means of a separate, insulated, code sized ground conductor.

I. Fittings: Boxes, extension rings, couplings, elbows and connectors shall be designed for use with raceway system.

J. Finish: To be determined by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of surface raceway installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY

A. Installation:

1. Install raceway in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

2. Contractor shall coordinate raceway lengths with building walls, counter, and actual field conditions.

3. Raceways mounted on walls above benches and counters shall align exactly with each end of bench or counter.

4. Use flat-head screws to fasten channel to surfaces, at heights indicated on Drawings, per Manufacturer's instructions. Mount plumb and level. Channel must be mechanically fastened; use of double-sided tape or other methods of attachment are not acceptable.
5. Installed complete with all necessary corner connectors, 'T' connectors, feed connectors, compartment dividers and any other hardware required to provide a complete system as described in the Drawings.
6. Provide fittings to feed the raceway from the back.

B. Branch circuiting: Provide connection to pre-wired or field wired assembly as indicated on Drawings. Install circuit identification tags on pigtails. Receptacles shall be identified with panel and circuit I.D. above each outlet with gray dymo label.

C. Grounding: Ground continuity shall be maintained throughout entire raceway length per CEC.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Wall switches.
2. Occupancy/vacancy sensors, including wallbox and ceiling mounted.
3. Time switches.
4. Receptacles.
5. Coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 03: Cast-in-place concrete.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. National Electrical Manufacturer's Association (NEMA):

NEMA WD-1;	General-Purpose Wiring Devices.
NEMA WD-2;	Semiconductor Dimmers for Incandescent Lamps.
NEMA WD-5;	Specific-Purpose Wiring Devices.
NEMA SSL 7A;	Phase-Cut Dimming for Solid State Lighting

2. Underwriter's Laboratories (UL):

UL 20	General-Use Snap Switches.
UL 231;	Power Outlets.
UL 310;	Electrical Quick-Connect Terminals.
UL 498;	Attachment Plugs and Receptacles.
UL 514A;	Metallic Outlet Boxes.
UL 514D;	Cover Plates for Flush-Mounted Wiring Devices.

UL 943; Ground-Fault Circuit-Interrupters.

UL 1681; Wiring Device Configurations.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

3. Provide color finishes for Architect to select from.

4. Submit Manufacturer's installation instructions.

B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.05 WARRANTY

A. Occupancy sensors offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Switches, receptacles and coverplates:

a. Pass & Seymour.

b. Hubbell.

c. Leviton.

2. Occupancy/vacancy sensors switches, time switches:

a. SensorSwitch, Inc.

b. Wattstopper

c. Cooper Controls “Greengate”

d. Leviton

e. Hubbell Building Automation, Inc.

3. Floor mounted service boxes:

a. Legrand

b. FSR, Inc.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 WALL SWITCHES

A. Standards: Provide general-purpose 120/277volt AC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Wall switches:

1. Provide twenty amperes, 120/277volt, Specification grade, toggle handle, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.

2. Single-pole, single-throw switches: Hubbell #1221 series, Pass & Seymour #20AC1 series or Leviton #1221 series.

3. Three-way switches: Hubbell #1223 series, Pass & Seymour #20AC3 series or Leviton #1223 series.

2.03 OCCUPANCY/VACANCY SENSOR SWITCHES

A. Occupancy sensors: automatic on, automatic off.

B. Vacancy sensors: manual on, automatic off.

C. General:

1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.

2. Sensors shall be dual-technology type infrared/ultrasonic or infrared/microphonic or as specified herein.

3. Neutral connection required. Sensors that rely on ground leakage current for operation shall not be provided.

4. All sensors shall have an adjustable time delay off setting and a sensitivity adjustment.

5. Ceiling mounted sensors shall operate be line voltage or low voltage with separate control unit. Control unit shall contain power supply and relays for switching loads.

6. Units shall be furnished with area coverage to suit application. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

D. Color: Device color shall be as selected by Architect, unless otherwise noted.

E. Wallbox mounted single level control sensors:

1. Sensor shall provide minimum coverage of 900-square feet.
2. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 4-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
3. Load capacity of 0 to 1800watts at connected voltage.
4. For use in small utility closets and similar areas where dual level switching is not indicated.

F. Wallbox mounted dual level control sensors:

1. Sensor shall provide dual level switching capability and minimum coverage of 1000-square feet.
2. Operation shall be manual (in two levels) “ON” and manual (in two levels) or automatic (full) “OFF”.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 20-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
4. Load capacity of 50 to 1000watts at connected voltages.
5. Integral photocell. Provide with ambient light control adjustment.
6. For use in offices and similar areas where dual level switching is indicated.

G. Wallbox mounted combination sensor and dimmer:

1. Sensor shall provide 0-10volt dimming capability for LED loads.
2. Sensor shall provide minimum coverage of 20-feet for clear line-of-sight applications.
3. Infrared only or dual-technology sensor.
4. Time delay adjustment from 3-minutes to 20-minutes. Set initial time-out setting at 15-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
5. For use in private offices and similar areas where dimming is indicated.

H. Ceiling or wall mounted single-directional sensors:

1. Sensor shall provide minimum coverage of 900-square feet.
2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up 2 sensors and mounted inside standard 4-inch square box.
6. For use in small office, classroom, and similar areas.

I. Ceiling mounted omnidirectional sensors:

1. Sensor shall provide minimum omnidirectional coverage of 1000-square feet.
2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.

3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up to 2 sensors and mounted inside standard 4-inch square box.
6. For use in large storage rooms and similar areas.

2.04 TIME SWITCHES

A. Wallbox mounted, line voltage type.

B. Shall be compatible with all LED lighting loads, electronic ballasts, motor loads, and inductive loads. Triac and other harmonic generating devices shall not be allowed.

C. Shall have no minimum load requirement and shall be capable of controlling up to 800watts.

D. Shall allow manual override of the preset time-out period.

E. Time switch shall be capable of operating as an “ON/OFF” switch.

F. Digital time switch:

1. Shall have the option for a beep warning that shall sound every 5-seconds once the time switch countdown reaches one minute.
2. Shall have an electroluminescent backlit Liquid Crystal Display that shows the timer’s countdown.
3. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.

G. Analog time switch:

1. Spring wound rotary style.
2. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.

H. Astronomical time switch:

1. Includes integral programming function for precise Time Zone, Longitude, and Latitude input/
2. Weekly schedule format.
3. Minimum 5 programmable schedules.

2.05 RECEPTACLES

A. Standards:

1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
3. Receptacles shall be the standard conventional style device.
4. Receptacles shall be tamper-resistant to meet the requirements of CEC Article 406.12.

B. Color:

1. Device color shall be as selected by the Architect, unless otherwise noted.
2. Devices connected to an emergency circuit shall be red.

C. General purpose single outlets:

1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #5361 series, Pass & Seymour #5361 series Leviton #5361 series.

D. General purpose duplex receptacles:

1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #5362 series, Pass & Seymour #5362 series or Leviton #5362 series.

E. Ground fault circuit interrupting (GFCI) receptacles:

1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.
4. Provide weather resistant devices at all damp and wet locations.
5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
6. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.

F. Controlled Receptacles:

1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device permanently marked with universal symbol for controlled receptacle, and the word “CONTROLLED”.
2. Controlled duplex receptacles shall include split circuit hot tab for one controlled outlet, and one uncontrolled.
3. Controlled double duplex receptacle shall consist of one uncontrolled general-purpose duplex receptacle, and one controlled duplex receptacle.
4. For half controlled receptacle with split-circuit hot tab, use Pass & Seymour #5362CH, Hubbell BR20C1, or Leviton 5362-1P.
5. For dual controlled receptacle, use Pass & Seymour #5362CD, Hubbell BR20C2, or Leviton 5362-2P.

G. USB Charger Type Duplex Receptacles

1. Provide 20amp, 125volt AC, tamper-resistant specification grade receptacles consisting of NEMA 5-20R duplex device with two 5volt DC USB Type A charging ports; compatible with USB 2.0 and 3.0 devices, and capable of charging two devices simultaneously while still using receptacles.
2. Comply with USB battery charging spec USB BC1.2
3. Minimum 3.1 amps total charging capacity.
4. Use Pass & Seymour TR5362USB series, Hubbell USB20X2 series, Leviton #T5832 series, for USB charger type duplex receptacles.

H. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.06 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design, standard conventionaldesigner decora style, throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be ivorywhiteblackgrayas specified by the Architect, unless otherwise noted.

C. Plastic coverplates:

1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Metal coverplates:

1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
3. Provide removable plastic film to protect coverplates during installation. Remove film at time of final acceptance.

E. Weatherproof coverplates:

1. Provide NEMA 3R die-cast aluminum, extra-duty weatherproof in-use coverplate for exterior GFCI receptacles per CEC Articl 406.9(B)(1), CEC Article 26-702 compliant, with 1/8” neoprene gasket, lockable hasp, 2.75” deep.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.03 INSTALLATION

A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.

C. Mount switches at 42 inches to center above finished floor unless otherwise noted.

D. Mount receptacles vertically with the centerline 18-inches above finished floor and with grounding slot at bottom.

E. Mount receptacles verticallyhorizontally when mounting above counters, mount with grounding slot to the left.

F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:

1. In bathrooms.
2. Where receptacles are installed within 6’0” from edge of sinks.
3. In kitchens above counters.
4. On rooftops.
5. Outdoors.
6. Where serving vending machines.
7. Where serving electric drinking fountains.

G. Derate ganged dimmer switches as instructed by Manufacturer. Do not use common neutrals in dimmer circuits.

H. Install red receptacles where connected to an emergency circuit.

I. Provide coverplates for all outlet boxes, switches, receptacles, etc.

J. Install blank coverplates on all outlet boxes in which no device is required or installed.

K. Provide coverplates that completely cover wall opening and seat against wall.

L. Provide stainless steel coverplates for all devices in kitchen/food service equipment areas.

3.04 OCCUPANCY/VACANCY WALLBOX SENSORS

A. All occupancy/vacancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.

B. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to values as indicated in Part 2 above.

C. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces. Mount devices at 42-inches to center above finished floor unless otherwise noted.

3.05 FLOOR MOUNTED SERVICE BOXES

A. Installation:

1. Install floor boxes to be level or within 1/16" below screed line.

2. Make conduit connections and anchor box to sub-flooring.

3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.

4. Make conduit connection to poke-through box from floor below.

B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.06 FIELD QUALITY CONTROL

A. Electrical testing:

1. Test proper polarity of all receptacles.

2. Test ground continuity of all wiring devices.

3. Test ground fault interrupting device operation.

B. Visual and mechanical inspection:

1. Check proper operation of all switches.

2. Check indicating lights on all SPD receptacles.

3. Visually inspect and replace damaged or defective devices.

3.07 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 26 28 16

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Fuses.
2. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 248(1-16);	Low-Voltage Fuses.
UL 489;	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
UL 512;	Fuseholders.

2. National Electrical Manufacturer Association (NEMA):

NEMA AB 1;	Molded Case Circuit Breakers.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe product operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
5. Provide current let-through and melting time information for each type and rating of fuses.
6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.

7. Submit Manufacturer's installation instructions.
8. Complete bill of material listing all components.
9. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Parts list and part numbers.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Fuses:

a. Bussmann Division, Cooper Industries.

b. Gould Shawmut Co.

2. Circuit breakers:

a. Square D.

b. ABB/ General Electric.

c. Eaton.

d. Siemens.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. Overcurrent protective devices shall satisfy all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708).

B. Fuses rated 1200 amps or higher shall satisfy CEC Article 240.67 requirements.

C. Circuit breakers rated (or can be adjusted) 1200amps or higher shall satisfy CEC Article 240.87 requirements.

2.03 FUSES

A. General: All power fuses shall be time-delay, high interrupting (300K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratio. Types of fuses shall be as follows:

1. 0 to 600amps: UL Class J, dual element, time delay type fuse with separate overload and short-circuit elements. The fuse shall hold 500% of rated current for a minimum of 10-seconds.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.

2.04 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480volt systems and 10,000 RMS symmetrical amps for 208volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.

G. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

H. All terminals shall be dual rated for aluminum or copper wire.

I. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.

J. Circuit breakers with frame ratings above 100amps through 400amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.

K. Circuit breakers with frame ratings above 400amps through 2500amps shall have microprocessor-based RMS sensing trip units with the following characteristics:

1. Interchangeable current rating plug or an adjustable trip setting to match the trip rating as indicated on Drawings.
2. Adjustable long-time pick-up setting. Minimum of five settings from 50% to 100%.
3. Adjustable long-time delay setting. Minimum of three delay bands.
4. Adjustable short time pick-up setting. Minimum of five settings from 200% to 800%.
5. Adjustable short-time delay setting. Minimum of three delay bands with I2t IN and OUT curves.
6. Adjustable instantaneous pick-up setting. Minimum of five settings from 200% to 1000%. Where the instantaneous feature is omitted on the Drawings, the trip unit shall have an instantaneous override feature.
7. Zone selective interlocking (ZSI) for short-time delay and ground-fault delay trip functions, if indicated on the drawings.
8. LED status indication to show “health” of trip unit.
9. Three-phase ammeter, if indicated on the drawings.
10. Trip indication targets on overload, ground fault and short circuit, if indicated on the drawings.

L. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

M. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.

N. Series rated breakers are not acceptable unless specifically noted on the Drawings.

O. Breaker shall be rated to operate in an ambient temperature of 40-degrees C and at 100% of their frame ampere rating on a continuous basis, if indicated on the drawings.

P. For circuit breakers rated or can be adjusted to 1200amps (or higher), provide zone selective interlocking (ZSI) with downstream protective devices, if indicated on the drawings. If ZSI is not

indicated on the drawings, provide a key interlock maintenance mode switch and blue LED indicating lamp in the same section, which shall allow an operator to manually enable temporary protective device maintenance settings to reduce the arc flash energy level. Key shall be held captive when maintenance mode signal is disabled and removable when maintenance mode signal is enabled. Maintenance mode switch positions shall be labeled “Enabled” and “Disabled”. Blue indicating lamp shall be push-to-test type.

Q. Refer to the Drawings for breakers requiring ground fault protection. See Section 262413: Switchboards for requirements of ground fault protection system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

D. Circuit breakers serving “Fire Alarm Control Panel(s)” shall be red in color.

3.03 ATTIC STOCK

A. Provide 1 set of spare fuses for every set installed.

3.04 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.

2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.

3. Prepare final test report including results, observations, failures, adjustments, and remedies.

4. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.

E. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.

2. Visual and mechanical inspection:

a. Inspect for physical damage, defects alignment and fit.

b. Perform mechanical operational tests in accordance with Manufacturer's instructions.

c. Compare nameplate information and connections to Contract Documents.

d. Check tightness of all control and power connections.

e. Check that all covers, barriers, and doors are secure.

3. Electrical tests:

a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.

b. Test all circuit breakers with frame size 225amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:

1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.

2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.

3) For circuit breakers rated or can be adjusted to 1200amps (or higher), confirm ZSI protection is acceptable or the maintenance mode switch is operational (enabled and disabled) with reduced pickup and delay measurements when enabled.

F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.05 ADJUSTING

A. Adjust circuit breaker trip settings based on recommendations of Section 260060: Power System Study.

B. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.

C. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.06 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

3.07 TRAINING

A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 28 19

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Disconnect Switches.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated on specified:

1. National Electrical Manufacturer Association (NEMA):

NEMA KS 1; Enclosed Switches.

2. Underwriters Laboratories, Inc. (UL):

UL 512; Fuseholders.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. As a minimum the following characteristics shall be indicated:

a. NEMA types.

b. Current rating.

c. Number of poles.

d. Fuse provisions.

e. Enclosure dimensions.

f. Voltage.

g. Horsepower rating (if applicable).

h. Short circuit rating.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

4. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Square D.
2. ABB/ General Electric.
3. Eaton.
4. Siemens.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 DISCONNECT SWITCHES

A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the “OFF” position.

B. Switch interior: Provide switch with switchblades that are fully visible in the “OFF” position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.

C. Switch mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the “ON” position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.

D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose, sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp, or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rust-inhibiting phosphate primer and finished in gray baked enamel.

E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600volt AC as required for the circuit involved and that meet “I-SQUARED-T” requirements. Fusible switches to have provisions for the types of fuses specified in Section 262816: Overcurrent Protective Devices. UL listed short circuit rating, when equipped with fuses to be 200,000amps RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600amps. 800amp switches and larger to have provisions for Class L fuses.

F. Provide separate safety, fused switches with proper sized fuses on all HVAC equipment and accessory motors and where required by equipment manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of disconnects switch installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to ensure that switches are insight of the controller as described in CEC Article 430.

3.03 INSTALLATION

A. Install disconnect switches where indicated on the Drawings.

B. Install fuses in fusible disconnect switches.

C. Include construction channel and mounting hardware as required to support disconnect switch.

3.04 IDENTIFICATION

A. Provide engraved, machine screw retained type 'NP' nameplate on each disconnect switch. See Section 260553: Electrical Identification.

B. Clearly indicate on the disconnect switch labeling of the breakers/panel feed to the disconnects/equipment.

3.05 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Interior luminaires (lighting fixtures.)
2. Light-emitting diode (LED) assemblies.
3. Drivers and transformers.
4. Optical components; including diffusers, refractors, reflectors, and louvers.
5. Unit battery equipment.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Division 03: Concrete; for cast-in place bases for lighting poles and bollards.
3. Division 05: Metals; for fittings, brackets, backing supports, rods, etc. as required for support and bracing of luminaires.
4. Division 09: Finishes; for ceilings, wall assemblies, acoustical treatment, and field painting of luminaires.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and Standards except as otherwise indicated or specified:

1. American National Standards Institute (ANSI):

ANSI/IEC 60529;	American National Standard for Degrees of Protection Provided by Enclosures (IP Code)
C137.0	Lighting System Terms and Definitions.
C137.1	0-10V Dimming Interface for LED Drivers and Controls

2. Underwriters Laboratories, Inc. (UL):

UL 66;	Fixture Wire.
UL 102.3;	Standard Method of Fire Test of Light Diffusers and Lenses.
UL 844;	Luminaires for Use in Hazardous (Classified) Locations.
UL 924;	Emergency Lighting and Power Equipment.
UL924a;	Auxiliary Power Supplies (for generator-backed systems.)

UL 1574; Track Lighting Systems.

UL 1598; Luminaires.

UL 1598C; Light-Emitting Diode Retrofit Luminaire Conversion Kits.

UL 1838; Low Voltage Landscape Lighting Systems.

UL 1993; Self-Ballasted Lamps and Lamp Adapters.

UL 2007A; Shatter Containment of Lamps for Use in Regulated Food Establishments.

UL 2108; Low Voltage Lighting Systems.

UL 2592; Low Voltage LED Wire.

UL 5085-3; Low Voltage Transformers: Class 2.

UL 8750; Light Emitting Diode (LED) Equipment for Use in Lighting Products.

UL 8753; Field-Replaceable Light Emitting Diode (LED) Light Engines.

UL 8754; Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays.

3. National Electrical Manufacturers Associations (NEMA):

SSL-1; Electronic Drivers for LED Devices, Arrays or Systems.

SSL-4; Retrofit Lamps—Minimum Performance Requirements.

77; Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria.

LE-4; Recessed Luminaires, Ceiling Compatibility

100; Wire Insulation Colors for Lighting Systems

4. Illuminating Engineering Society of North America (IESNA):

TM-15; Luminaire Classification System for Outdoor Luminaires.

TM-21; Projecting Long Term Lumen Maintenance of LED Light Sources.

TM-30; Method for Evaluating Light Source Color Rendition.

TM-30-Annex E Recommendations for Specifying Light Source Color Rendition

LM-79; Electrical and Photometric Measurements of Solid-State Lighting Products.

LM-80; Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.

LM-84; Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires.

LM-86; Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components

5. Restriction of Hazardous Substances (RoHS):

RoHS 3; Directive 2015/863 - Cat 5. Lighting: lamps, luminaires, light bulbs.

1.03 SYSTEM DESCRIPTION

A. Provide and install a fully functional and operating lighting system as indicated, complete with light engines, lamps, wiring, and securely attached to support system to meet all seismic code requirements.

B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.04 SUBSTITUTIONS

A. Refer to Section 260010: Basic Electrical Requirements for specific Equipment requirements.

B. Items specified under this Section and Luminaire Schedule are subject to the requirements, with the following qualifications:

1. Items solely specified by Manufacturer name and catalog number, without qualifiers: Provide as specified – No Substitutions.

2. Items specified by multiple Manufacturers, without qualifiers: Provide any listed manufacturer – No Substitutions.

3. Items specified by sole or multiple Manufacturers, followed by “Or Approved Equal” or “Or Approved Equivalent”: Conform to substitution requirements outlined for Equipment.

4. Items specified by sole or multiple Manufacturers, followed by “Or Equal” or “Or Equivalent”: Products that meet the salient requirements are acceptable to provide.

a. Equivalency is at the sole judgement of the Architect and Engineer.

b. Should a submitted, unspecified product fail to meet the requirements of Equivalency, provide specified products at no additional cost to the Owner.

C. Equivalency shall be determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on any characteristic shall constitute justification for rejection of the submittal or substitution.

1. Performance:

a. Distribution.

b. Utilization.

c. Luminance distribution (Average brightness / maximum brightness.)

d. Spacing to mounting height ratio.

e. Overall luminaire efficiency.

2. Construction:

a. Engineering.

b. Workmanship.

c. Rigidity.

d. Permanence of materials and finishes.

3. Installation Ease:

a. Captive parts and captive hardware.

b. Provision for leveling.

c. Through-wiring ease.

4. Maintenance:

a. Ease of relamping / replacement of LED array.

b. Ease of replacement of driver/ballast and lamp sockets.

5. Appearance:

a. Architectural integration.

b. Light tightness.

c. Styling.

d. Conformance with design intent.

e. When requested, furnish a working sample complete with housing, trim, 8’ cord and plug, and specified lamp.

1.05 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Complete bill of material listing (index) of all luminaires. Index shall be organized in the same sequence as the Luminaire Schedule (alphabetical.) Include in the index:

a. Type per the Luminaire Schedule.

b. Manufacturer.

c. Complete catalog number, including all accessories and appurtenances required for the installation.

d. Voltage.

e. Poles, arms, and brackets, if applicable.

f. Lamping, if applicable.

2. Manufacturer’s data sheets/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

a. Identify luminaire type on each sheet.

b. Clearly mark on each data sheet the specific item(s) being submitted. Obfuscate or otherwise delete options on data sheets that are not provided.

3. Driver or transformer and/or lamp data sheets as applicable to submitted item.

4. Manufacturer's installation instructions.

5. Warranty.

6. U.L. labeling information.

7. Photometric Reports consisting of:

a. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminance data for vertical angles above 45 degrees from nadir.

b. Coefficient of utilization table.

c. Zonal lumen summary including overall luminaire efficiency.

8. Shop Drawings:

a. Where noted in the Luminaire Schedule, submit Shop Drawings from Manufacturer detailing modified or custom luminaires indicating dimensions, weights, methods of field assembly, components, features, accessories, methods of support, etc.

9. Mock-ups: Provide mock-up luminaire samples where “MOCK-UP” is indicated in the Luminaire Schedule. Refer to Part 3 – Execution for requirements.

1.06 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. An updated index per 1.05-A.

2. One complete set of final submittals of actual product installed, including product data and shop drawings.

3. Instructions for routine maintenance.

4. Pictorial parts list and parts number.

5. Telephone numbers for authorized parts and service distributors.

1.07 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Luminaires shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Luminaires, Poles, and Exit Signs: as listed in the Luminaire Schedule.
2. Light-Emitting Diode (LED) Arrays:
    a. Cree.
    b. Nichia.
    c. Citizen.
    d. Lumileds.
    e. Samsung.
    f. Lumenetix Araya.
    g. Xicato.
    h. Bridgelux.
    i. LEDs provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
3. LED replacement and integral-driver lamps:
    a. General Electric.
    b. Osram.
    c. Cree.
    d. Maxlite.
    e. Green Creative.
    f. Soraa.
4. LED drivers (DC output):
    a. eldoLED.
    b. Lutron.
    c. Signify Advance.
    d. Osram.
    e. Q-Tran.
    f. Universal Lighting Technologies.
    g. Drivers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

5. Transformers for LED systems (AC output):
    a. Q-Tran.
    b. Hatch.
    c. Semper Fi.
    d. Transformers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
6. Unit battery equipment:
    a. Philips Bodine.
    b. Myers/Iota.
    c. Unit battery equipment provided by Luminaire Manufacturers listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.

B. Luminaire assemblies U.L. listed appropriate to mounting conditions and application. All labels affixed to the luminaire shall be in a location not visible from normal viewing angles.

C. Each luminaire family type (downlights, etc.) supplied by only one manufacturer.

D. Recessed luminaires installed in fire rated ceilings and using a fire rated protective cover shall be thermally protected for this application and shall carry a fire rated listing.

E. Luminaires installed under canopies, roofs or open areas and similar damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.

F. Luminaires shall bear the IP rating appropriate for the application.

G. Luminaires shall be free of light leaks and shall be designed to provide sufficient ventilation of light engines, including ventilation holes where required.

2.03 LUMINAIRE CONSTRUCTION

A. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. 20-gauge (0.7-mm or 0.027-inch) minimum.

1. Finish: Baked white dry polyester powder, unless otherwise specified, with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process prior to painting.
2. Luminaire (including all painted component parts) shall be painted after fabrication unless specifically noted in the Luminaire Schedule.

B. Extruded Aluminum Housings: One-piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.

C. Die-Cast Aluminum Housings:

1. Single-piece casting to ensure water tightness.
2. Low copper (<0.7% Cu) aluminum alloy.
3. Minimum Class 4 Consumer Grade per NADCA Standards.

D. All surfaces shall be cleaned and dressed to eliminate all exposed sharp edges or burrs.

E. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.

F. End Plates: Die cast end plates shall be mechanically attached without exposed fasteners. End caps shall be minimum 0.125" thick.

G. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.

H. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.

I. Fasteners shall be manufactured of galvanized steel.

J. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.

K. Recessed luminaires: Equip with through-wire junction box. Box, driver, and replaceable components shall be accessible from the ceiling opening of the luminaire.

L. Finish:

1. All exposed aluminum surfaces shall be treated with an acid wash and clear water rinse prior to painting. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
2. All exposed steel surfaces shall be treated with an acid wash and clear water rinse, then prime coated. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.

M. Door Frames for lensed luminaires: White painted, flat aluminum with mitered corners.

2.04 SUSPENSION

A. Suspension Devices, type as specified in the Luminaire Schedule:

1. Aircraft Cable: Stainless steel type - 3/32” nominal diameter, stranded, with positive pressure, field adjustable clamp at luminaire connection.
2. Rigid Pendant: ½” nominal diameter or as specifically shown on drawings. Supplied by luminaire manufacturer when available as standard product. At luminaire end of stems, provide earthquake type swivel fitting to permit 45-degree swing in any direction away from vertical.
3. Chain hangers: Length to suit mounting height if shown or as field conditions dictate. Use two heavy duty chains with “S” hooks at each suspension point. Length to suit mounting height as shown on Drawings.

B. Suspension system must permit ±13-mm (1/2”) minimum vertical adjustment after installation.

C. Supports:

1. Provide internal safety cable from luminaire body to stud in outlet box.
2. Carry luminaire weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

D. Feed Point:

1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
2. At the electrified connection provide straight cord feed.
3. Power cord: white multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).
4. Where emergency feed is required, a separate feed point shall be provided.

E. Non-feed Points:

1. 13-mm (½") O.D. polished chrome end sleeve, inside threaded ¼"-20, with 50-mm (2") diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
2. Contractor to provide support above ceiling as required.

F. Suspension method shall allow adjustment to be made in hanging length to allow for variance in ceiling height.

G. All exposed paintable suspension components shall have the same finish and color as the luminaire housing.

2.05 LAMPHOLDERS

A. Of configuration and design to accept standard lamp bases.

B. Wiring channels and lampholder mountings shall be rigid and accurately constructed.

C. Integral-driver LED:

1. Medium screw base: Unglazed porcelain body or thermoplastic (PET GF) with copper-alloy screw shell. 660watt, 250volt rated.
2. Bi-Pin base: Ceramic casing with mica cover plate, copper allow contact surfaces. Pin distance designed for lamp provided.

2.06 LED ARRAYS

A. Minimum lumen maintenance per LM-80 measurements and TM-21 calculations: L90 at 60,000 hours.

B. Maximum burnout: B90 at 200,000-hours.

C. Free of mercury and toxic materials; RoHS compliant.

D. Linear LED boards: LED pitch shall be consistent throughout the luminaire and shall remain consistent from the end of one board to the start of the next. LED pitch shall be the same from the endcap of the luminaire to the last LED on the board as the LED pitch throughout the luminaire. Luminaire shall have a continuous luminous appearance – bright or dark spots are not acceptable.

E. White LEDs:

1. Interior
    a. Correlated Color Temperature (CCT): 4000K
    b. Minimum efficacy: 75 lumens per watt.
    c. L70 lifetime: minimum 80,000-hours (extrapolated.)
    d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 3-step MacAdam ellipse variation throughout listed life (L70).
    e. Color Rendering Index (CRI); minimum 80 Ra.
    f. R9 value; minimum 30.
    g. TM30 values; Rf >75, 92>Rg>110.

2.07 LED DRIVERS:

A. LED drivers shall be integral to luminaire housing or remotely located, when specified, within 15 feet of diode assembly.
    1. Luminaires shall be provided with the UL listed or equivalent driver and low voltage power supply as recommended by Manufacturer to insure proper and consistent lamp and luminaire performance. The number of LEDs per luminaire per power supply shall not be exceeded, and LEDs shall not be wired to a high capacity driver unless recommended by Manufacturer.
    2. Light Emitting Diode (LED) control gears shall operate with sustained variations of +/- 10% in voltage and frequency without damage to the driver and have a power factor not less than 90%. Regulations: +/-5% across the listed load range.
    3. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%. The Driver shall have a Class A sound rating unless otherwise specified.
    4. Control gear shall be rated for 50-degree C ambient temperature.
    5. All control gear shall facilitate smooth, flicker-free dimming from 100% to 10%, 1% or 0.1% as noted on the Luminaire Schedule.

2.08 LENSES

A. Acrylic:
    1. Lenses shall be extruded or injection molded crystal clear 100% virgin acrylic (except as indicated otherwise). For lenses with male pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones) or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.
    2. Lenses shall fully eliminate lamp images when viewed from all directions within 45 to 90-degree angles from vertical, where the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from 0 to 45-degrees the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
    3. Finishes (i.e. sandblasting, etching, polishing) shall be performed as described in the Luminaire Schedule.

4. Plastic electrical light diffusers must meet the requirements of Section 2-5209, CAC, Flame Spread Rating.
5. Prismatic Acrylic:
    a. Extruded of clear virgin acrylic plastic, 0.125" minimum overall thickness, 0.100” nominal unpenetrated thickness, Pattern 12 with flat sided female prisms running at 45 degrees off panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
6. Opal acrylic:
    a. Extruded or injection molded of virgin acrylic plastic, 0.080" minimum overall thickness.

2.09 UNIT BATTERY EQUIPMENT

A. LED Emergency Power Supplies
1. Standard Features:
    a. Safety compliance to UL 924; CAN/CSAC22.2 No.141-10 and NFPA requirements for 90-minute egress
    b. Open circuit / short circuit protection
    c. Operating temperature: 32-degree F/0-degree C to 122-degree F/50-degree C
2. Test switch / charging indicator light
3. Emergency reaction time < 1-sec
4. Powder coat steel, stainless or galvan-nealed case
5. Field-replaceable NiCd battery pack (x2) with quick connect
6. Min. lead wire length: 6in UL 1452 solid / #18 AWG 1000volt / 90-degree C

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of luminaire installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all luminaires. Locate as shown on the architectural elevations and reflected ceiling plan.

B. Consult Architectural Drawings for details of ceiling construction, finish, and other applicable details.

C. Contractor shall be responsible for coordination of luminaire mounting and compatibility with ceiling construction.

D. Luminaires in areas where exposed or concealed pipe and ductwork prevents direct access to the structural ceiling shall be provided with appropriate support system to install luminaire below obstructions to avoid conflicts with same.

3.03 ARCHITECTURAL COORDINATION

A. Where luminaires are mounted in architectural coves, soffits, valances, or cabinets and are given an overall length, the Contractor shall verify all lengths in the field prior to releasing order.

B. Where luminaires are surface mounted or suspended to match the length of walls or other architectural elements, the Contractor shall verify all lengths in the field prior to releasing order.

C. Mounting heights specified on drawings:

1. Wall mounted luminaires: shall be to centerline of luminaire.

2. Pendant mounted luminaires: shall be to bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.

3.04 INSTALLATION

A. Install luminaires in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Contractor shall be responsible for all supports, hangers, and hardware necessary for a complete installation.

C. Luminaires shall be plumb, level, square, in straight lines and without distortion.

D. Remedy light leaks that may develop after installation of recessed or enclosed luminaires.

E. Adjustable luminaires shall be installed with “dead” zone of rotation away from intended aiming point.

3.05 LUMINAIRE SUPPORTS

A. Physical (gravity) supports:

1. Recessed luminaires in wood framed ceilings shall be supported by 2" x 4" hangers fastened to adjacent ceiling joists.

2. Recessed downlights in wood frame ceilings shall be supported with Manufacturers supplied bar hangers and shall be installed according to the Manufacturer’s instructions.

3. Surface mounted luminaires solely supported by recessed boxes in a gypsum board ceiling shall have a 1-1/8" steel bar screwed or welded to the back of the box. This steel bar must be long enough to span two ceiling support channels and shall be attached to the channels by twisting wire around the bar and the support channel. For luminaires weighing over 50-pounds, provide studs in recessed box.

4. Support surface mounted luminaires more than 18" wide at or near each corner or edge, in addition to support from outlet box.

5. Support recessed downlights manufactured with built-in brackets by twisting wire around the bracket and two adjacent ceiling support channel runners on either side of the luminaire.

6. Support outlet boxes as specified in Section 260533: Boxes. Provide all boxes with grounding pigtail.

7. On concrete ceilings, use one of the following for supporting luminaires other than by outlet box:

a. Preset concrete inserts, provided inserts are completely covered by the luminaire after installation.

b. 1/4-20 threaded appropriate length wedge type anchor.

B. Seismic supports:

1. Recessed luminaires in suspended ceilings shall be supported by connecting two support wires to the luminaire at diagonal opposite corners for luminaires weighing 56 pounds or less. Connect four wires, one at each corner for luminaires weighing more than 56 pounds.

2. Surface mounted luminaires on suspended ceilings shall be attached to the main ceiling runner with at least two positive clamping devices and shall have an additional support wire attached to each clamping device and to the structure above.

3. Recessed downlight luminaires in suspended ceilings shall be supported by connecting one support wire to the luminaire housing.

4. All suspended luminaires shall be able to swing 45-degrees from vertical in any direction without obstruction.

a. Furnish suspended rigid pendant luminaires with universal joint type hanger canopy and longitudinal sway adapter at each stem, to permit 45-degree swivel on 360-degree circle at canopy and 45-degree longitudinal movement at sway adapter.

b. Submit Drawings of hanger assembly for review prior to ordering.

c. If suspended luminaire is not free to swing 45-degrees in any direction, without obstructions, provide seismic restraint to prevent contact in conformance with California Uniform Building Code, Section 2330, Seismic Design.

5. All recessed modular luminaires shall be furnished with earthquake clips where installed in tee bar ceiling.

3.06 ATTIC STOCK

A. Spare Parts: Provide spare parts totaling 5 percent of the quantity specified, or two total, whichever is greater, of the following:

1. Luminaires:

2. Lenses:

3. LED Drivers:

4. LED Modules:

3.07 IDENTIFICATION SYSTEM

A. All concealed junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.08 FIELD QUALITY CONTROL

A. Visual and mechanical inspection:

1. Inspect for physical damage, defects, alignment and fit.

2. Perform operational test of each luminaire after installed, circuited, and energized.

3. Perform emergency operational test of all luminaires connected to emergency circuiting by simulating normal power source failure.

B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.09 MOCK-UPS

A. The purpose of the mock-up is to study the general appearance and performance of and to make comparisons between the various lighting systems. At that time, certain minimal test variations may be requested as to lamp location, lamp type, reflector shape, color, etc. Final modifications, if any, shall be considered a part of these Specifications and shall be accomplished with no additional cost to the Owner.

B. Where noted in the Luminaire Schedule, the Contractor shall provide sample(s) for use in full-size field mockup of specific luminaires.

C. The Contractor shall allow time in the bid and be responsible for procuring and installing a sample luminaire on the Project for review, prior to acceptance and final installation.

D. This mock-up will be required to be coordinated and reviewed with the Owner's Representative and the Architect or Engineer.

E. The Contractor shall be responsible for providing the labor and materials for the field mock-up including, but not limited to, special rigging or scaffolding and adjustments in the field, as directed by the Architect or Engineer.

F. The mock-up installation shall closely conform to the conditions of the actual final installation as to height, distance from adjacent surfaces, number and type of lamps, material, color, etc.

G. The Contractor shall submit a written description of each proposed mock-up with Drawings in order to obtain Architect’s approval prior to commencement of each mock-up.

H. Exterior mockups will occur at night, starting 2-hours after local sunset. Dates to be coordinated with design team to suit schedules. Contractor to propose multiple dates at least 4 weeks in advance.

I. Allow two, 6-hour mockup sessions per luminaire. The second mockup, if required, will occur after additional or alternate equipment is available.

J. Contractor to provide all required security, sidewalk closures, lifts, walkie-talkies (4 minimum) and manpower to make changes to color and intensity of the temporary luminaires.

K. Mockup luminaire shall not be used for final permanent installation unless approved by the design team.

3.10 ADJUSTING AND AIMING

A. Aiming will occur at night under the direction of the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for field aiming. This shall include, but not limited to, special rigging or scaffolding, adjusting luminaires in field, testing of various lenses or louvers, as directed by the Architect or Engineer.

B. Aim all directional luminaires, including but not limited to luminaires described in the Contract Documents or by the luminaire manufacturer as "aimable," "adjustable," or "asymmetric" as follows:

1. To provide the lighting pattern for which the luminaire is designed.

2. To provide the lighting pattern as shown on the drawings.

3. To predetermined aiming points as shown on the drawings.
4. Where aiming cannot be determined, request, in writing, clarification from the Specifier, indicating luminaires needing clarification.

C. Re-aim luminaires as determined by Architect during final project walkthrough.

3.11 CLEANING

A. Clean luminaires prior to Project closeout in accordance with Manufacturer's recommended materials and methods.

B. Remove all debris, fingerprints, and packaging remnants.

END OF SECTION

SECTION 27 00 00

COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the common administration basic requirements and common methods for all low voltage systems installation work included under Division 27 and 28 (and other Divisions). Where those requirements differ from the requirements of this section, the more stringent shall govern.

1.02 STANDARDS, REGULATIONS, AND CODES REFERENCES

A. The following Standards, Regulations and Codes apply to work specified in the Contract Documents.

1. Applicable State and Local Codes.
2. California Building Code and California Electrical Code, Current Editions.
3. BICSI TDMM (Telecommunications Distribution Methods Manual), 11th Edition 2006.
4. ANSI/TIA/EIA-568-B.1. Commercial Building Telecommunications Cabling Standard,
5. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 2, Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cabling.
6. ANSI/TIA/EIA-568-B.1-3. Commercial Building Telecommunications Cabling Standard.
7. ANSI/TIA/EIA-568-B.1-4. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 4, Recognition of Category 6 and Category Cat 6A and 50 nm Laser-Optimized 50/125 um Multimode Optical Fiber Cabling.
8. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
9. ANSI/TIA/EIA-568-B.2-1. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 1, Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
10. ANSI/TIA/EIA-568-B.2-10 (draft 2.0). Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 10, Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6 Cabling.
11. ANSI/TIA/EIA-568-B3.3 Optical Fiber Cabling Components Standard.
12. TIA-569-B. Commercial Building Standard for Telecommunications Pathways and Spaces.
13. ANSI/TIA/EIA-606-A. Administration Standard for Commercial Telecommunications Infrastructure.
14. ANSI/TIA/EIA-607-A. Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
15. TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
16. TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines.

1.03 DEFINITIONS

A. The following is a list of abbreviations generally used in Divisions 27 & 28:

1. ADA - Americans with Disabilities Act
2. AHJ - Authority Having Jurisdiction
3. ANSI - American National Standards Institute
4. APWA - American Public Works Association
5. ASTM - American Society for Testing and Materials
6. CBC - California Building Code
7. CEC - California Electrical Code
8. CFC - California Fire Code
9. FCC - Federal Communications Commission
10. HVAC - Heating, Ventilating and Air Conditioning
11. IEC - International Electro-technical Commission
12. IEEE - Institute of Electrical and Electronics Engineers.
13. IETA - International Electrical Testing Association
14. FM - FM Global
15. NEMA - National Electrical Manufacturers Association
16. NFPA - National Fire Protection Association
17. OSHA - Occupational Safety and Health Administration
18. UL - Underwriters Laboratories Inc.

B. Provide: To furnish and install, complete and ready for the intended use.

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly, and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning, and similar operations at the project site to complete items of work furnished by others.

E. Following is a list of commonly used terms:

1. Active Equipment: Electronic equipment used to develop various WAN and LAN services.
2. Backbone: A collective term sometimes used to describe the campus and vertical distribution subsystem facilities and media interconnecting service entrances, communications rooms, and communications cabinets.
3. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to safely conduct currents likely to be imposed on it.
4. Cabinet: Wall-mounted modular enclosure designed to house and protect electronic equipment.
5. Cable Tray: Vertical or horizontal open supports, usually made of aluminum or steel, that are fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.
6. Campus: Grounds and buildings of a multi-building premises environment.

7. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connections to active equipment.
8. Cross-Connect: Equipment used to terminate and tie together communications circuits.
9. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
10. District Representative: Persons employed directly by the District (Staff), personnel of a third-party Construction Management firm that is contracted by the District, and/or personnel of a third-party Consulting firm that is contracted by the District.
11. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities. Also known as LIU.
12. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
13. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.
14. Horizontal: Pathway facilities and media connecting the MDF or IDF to Telecommunications Outlets.
15. Intermediate Distribution Frame (IDF): Data networking equipment rack and/or location that serves an individual area, floor or building. Downstream from the MDF.
16. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
17. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.
18. Local Area Network (LAN): Data transmission facility connecting several communicating devices, typically Ethernet and the network is limited to a single campus.
19. Main Distribution Frame (MDF): Initial (main) data network equipment rack and/or location. Only one MDF occurs per site and may serve many downstream IDFs.
20. Media: The type of cable (e.g., twisted-pair, coaxial, or fiber optic) used to provide signal transmission paths.
21. Minimum Point of Entry (MPOE): The location where the service provider hands off connection and responsibility for service to on-premise customer owned equipment.
22. Modular plug: An eight-position, eight-conductor end-of-wire electrical connector used with Category rated cable.
23. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, FDUs, etc.
24. Patch Cord: A length of copper or fiber cable with connectors on both ends used to join communications circuits at MDF/IDF and end stations.
25. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate the administration of cross-connect fields.
26. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, underfloor systems, raised floor, ceiling support wires, etc.
27. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.

28. Raceway: An enclosed channel designed expressly for holding wires or cables; may either conductive metal or insulating plastic. The term includes conduit, tubing, wireway, underfloor raceway, and surface raceway; does not include cable tray.
29. Rack: An open or enclosed structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack. Maybe freestanding and floor mounted or a wall mounted cabinet. Industry standard 19" width spacing.
30. Wiring Block: Punch down terminating equipment used to develop twisted pair cross-connect facilities.

1.04 PRODUCT AVAILABILITY

A. Products with long delivery lead times are to be brought to the attention of the District's representative.

1.05 PRODUCT SUBMITTALS

A. See Division 01 Submittals for more requirements

1.06 SUBSTITUTION LIMITATIONS

A. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved, and show demonstrated and documented equivalence to the product(s) specified. Documentation includes, but is not limited to, product samples, data sheets, and actual test data. The request for product substitution, and supporting documentation, must be submitted to the District's representative in writing.

B. See Division 01 Substitutions for more requirements

1.07 QUALITY ASSURANCE

A. The Contractor is to conform to requirements of the latest adopted version of the CEC with amendments by local AHJs.

B. The Contractor is to conform to the latest adopted version of the CBC with amendments by local AHJs.

C. The Contractor is to obtain and pay for electrical permits, plan review, and inspections from local AHJs.

D. The Contractor is to furnish products listed by UL or other testing firm acceptable to AHJ.

E. The Contractor is to conform to requirements of the Service Providers (i.e., electric, telephone, broadband and cable television).

F. Contractor Qualifications:

1. The Contractor shall have a minimum of five years' direct experience with the product they are installing. Installation technicians shall be certified and with a minimum of three years' direct experience with the product they are installing.
2. The Contractor shall maintain a local (within 50 miles of District) service facility which stocks spare devices and/or components for servicing systems.
3. The Contractor shall have performed successful installation of at least three projects similar in scope and size. The Contractor must be able to provide project references for these three projects, including scope of work, project type, owner/user contact name and telephone number.
4. For sections requiring installation personnel to be certified by the manufacturer, the Contractor selected for this project shall provide current certificates for all technicians working on the project.
5. The Contractor shall hold and maintain a valid California C-7 or C-10 State Contractors License and can exhibit validity upon request.
6. The Contractor shall provide a list of test equipment proposed for use in verifying the installed integrity of systems installed.
7. The Contractor shall provide the resume for the Contractor's Project Manager and on-site Installation Supervisor who will be assigned to this project.
8. The Contractor shall provide a list of technical product training attended by the contractor's personnel that will install the specified manufacturer system.
9. The Contractor shall provide a list of Sub-Contractor(s) who will assist the Contractor in the performance of this work.

1.08 SEQUENCING AND SCHEDULING

A. For the proper execution of the work, the Contractor shall cooperate with other tradecrafts and contracts as needed.

B. To avoid installation and scheduling conflicts, the Contractor shall thoroughly examine the complete set of Contract Documents and resolve any conflicts the District's representative prior to installation.

1.09 SHOP DRAWINGS

A. Shop Drawings: When required by individual Specification Sections, the Contractor shall provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, point-to-point wiring diagrams for all connections, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

1.10 WARRANTY

A. The Contractor shall provide an extended manufacturer's warranty on the Backbone and Horizontal Communications systems as specified in other sections of Division 27.

1.11 CLOSE OUT DOCUMENTS

A. The Contractor shall provide final coordination drawings, with as-built information added, which are to be submitted as record drawings at completion of project.

B. Red-Line Drawings. The Contractor shall provide a clean set of Construction Drawings marked in red with the following:

1. All installation changes and deviations from the Construction Drawings (including all Addendums and change order documents).
2. All exact routes of installed pathways (sleeves, conduit, surface raceway, etc.).
3. Exact location of racks, cabinets, control panels, and the like.

C. Operation and Maintenance Documentation: The Contractor shall provide copies of certificates of code authority acceptance (i.e. Fire Alarm IOR), product data, guarantees, warranties, installation guides, maintenance guides and the like.

D. Inspection and/or testing: The Contractor shall submit testing reports for testing that was required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The Contractor shall provide like items from one manufacturer, such as wire/cable, jacks, modular plugs, patch panels, equipment connection cords, wall plates, and the like. See individual sections for detailed information.

2.02 MATERIALS

A. The Contractor shall provide new materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and quality.

B. The Contractor shall provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide plenum rated cables in ceilings that are utilized as air return plenums.

C. The Contractor is responsible for a complete and operable system and shall provide all incidental materials and accessories not specifically mentioned herein or noted on Drawings but needed for a complete and operable system, that is satisfactory to the District.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Construction Documents:

The Construction Drawings are diagrammatic with symbols representing Division 27/28 equipment, outlets, accessories, wiring etc.

2. The Contractor shall examine the entire set of Construction Drawings to avoid conflicts with other systems. The Contractor shall determine the exact route and installation of wiring and equipment and coordinate with other trades and/or construction conditions.

3.02 INSTALLATION

A. The Contractor shall install Division 27/28 equipment completely as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the equipment and examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from the District's representative prior to proceeding with the installation.

B. The Contractor shall not install equipment and/or wiring in obvious passages, doorways, scuttles, or crawl spaces, which would impede or block the passage's intended usage.

C. The Contractor shall not install equipment in locations where it would obviously be subject to damage during normal use.

3.03 FIELD QUALITY CONTROL

A. Tests: The Contractor shall conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 27/28. Refer to individual Specification Sections for required tests. Testing documentation is to be included in Closeout Documents.

3.04 CLEANING

A. The Contractor shall remove all dirt and debris caused by the execution of the work in all cabinets, surfaces and floors.

B. The Contractor shall leave the entire Division 27/28 systems installed under this Contract in a clean, dust-free, and proper working order.

C. The Contractor shall clean interiors of new and modified equipment enclosures.

END OF SECTION

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies the basic materials and methods for all low voltage pathways installation work included under Division 27 and 28. Where those requirements differ from the requirements of this section, the more stringent shall govern.

B. This section adds refinements to Division 26 that apply to Division 27/28 communications and low-voltage systems.

1.02 SCOPE

A. Materials and/or methods for the following.

1. Communication services
2. Grounding
3. Fasteners
4. Hangers and supports
5. Conduits/Backboxes/Raceways
6. Underground
7. Sleeves and penetrations

1.03 SUBMITTALS

A. Submittals shall be made in accordance with District submittal procedures, see Division 01 Submittals for requirements.

1.04 RELATED REQUIREMENTS

A. Division 07 – Thermal and Moisture Protection

B. Section 09 91 00 - Painting

C. Division 26 – Electrical

D. 27 00 00 – Communications Basic Requirements

1.05 REFERENCES

A. ANSI American Nation Standards Institute

B. NFPA 70 – National Electrical Code

C. UL Underwriters Laboratory

D. California Building Code (CBC)

E. California Electrical Code (CEC)

1.06 WARRANTY

A. Refer to Division 01 -— Warranties

PART 2 – PRODUCTS

2.01 All products used on this project shall bear the label of- and be approved by Underwriters Laboratories unless otherwise approved in writing by the District's representative. See Appendix A for pre-approved materials.

2.02 GROUNDING BUS BAR

A. Copper bus bar 2"x10"x1/4" minimum size with stand-off brackets and insulators, pre-drilled and threaded mounting holes (hole qty. 12 or greater) for equipment grounding lug attachment. Approved Manufacturer is Chatsworth Products.

2.03 FASTENERS

A. Mounting hardware and anchors recommended by the manufacturer of any material that shall be mounted to the building or structure.

1. Sheet rock / drywall / wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equivalent.
2. Concrete / cinder block / solid masonry: Expanding compression type lag, expanding compression type bolt, expanding compression type, all-thread with nuts, or approved equivalent.
3. Tile / Stucco / hollow masonry: Toggle bolts or approved equivalent.
4. Wood: Lag screws, wood screws, or approved equivalent.
5. Metal: Beam clamps, sheet metal screws, self-drilling screws or approved equivalent.

2.04 CABLE HANGERS AND SUPPORT

A. D-Rings

1. Commercial grade

B. J-Hooks (For bundles of 24 cables or less)

1. Commercial grade (See Appendix A)
2. Colored coded by system:
   a. No color = Data
   b. Orange = Fiber optic cables and service provider feeders
   c. Blue = CCTV, Electronic Access Control, and Intrusion
   d. Yellow = Audio-Visual (non-data)
   e. Green = EMS and lighting controls
   f. Red = Fire Alarm

2.04 SURFACE RACEWAY

A. The District has standardized the use of Wiremold 800, 2300, 5400 and 5500 series for non-metallic surface raceway.

2.05 CONDUITS AND ACCESSORIES

A. CONDUITS

1. See Division 26 for additional requirements.
2. For new construction, exposed Fire Alarm pathways to be in red painted conduit.
3. All new conduits shall be sized accordingly to achieve a 40% maximum fill ratio with initial cables installed.
4. Underground conduits shall be Schedule 40 PVC.

B. INNERDUCT

1. Orange corrugated HDPE (High Density Polyethylene) Innerduct shall be used for fiber optic cable protection in interior locations.
2. Fabric multi-cell innerduct is approved for underground conduits 2” and larger.

C. FITTINGS:

1. See Division 26 for additional requirements.
2. Commercial grade.
3. Compression type.
4. Conduit bodies and any other sharp bend fittings are strictly prohibited for communication Cat6A and fiber optic cables. Appropriate conduit sweeps are required.

B. PULL LINE

1. Minimum 1/8" diameter or larger braided line of polypropylene or continuous fiber polyolefin. The minimum breaking strength of 1/8 in. line is 200 lbs.

C. SLEEVES

1. All conduit sleeves shall be of sufficient quantity and size to achieve a 40% maximum fill ratio with initial cables installed.

2. Penetrations through rated assemblies to use EZ-Path or an approved equal.

2.06 CABLE TRAYS

A. Cable trays (For cable bundles of 25 or more)

B. For above ceilings wire basket cable trays are approved and an approved manufacturer is SnakeTray.

C. For exposed areas, solid cable trays are required and an approved manufacturer is MonoSystems.

2.07 BACKBOXES AND JUNCTION BOXES

A. Galvanized one-piece or welded pressed steel type. Boxes for fixtures shall not be less than 4” square and shall be equipped with fixture stud. Boxes shall be at least 2-1/8” deep, 4” square for 1 or 2 gang devices, with device rings. Boxes mounted in wall or ceiling finished with 5/8” gypsum board shall be furnished with 5/8” deep device rings. Provide blank cover for all boxes without fixture or device. 4 11/16 and/or 5” square back boxes may be required for larger cable requirements.

B. Junction boxes, larger than 8”, located indoors shall be hinged, NEMA-1 rated.

C. Junction boxes, larger than 8”, located outdoors, or in wet or damp locations shall be hinged, NEMA-3R.

D. Provide and install tamper-proof screws for all exterior box lids.

E. Junction boxes used for Fire Alarm systems are to be red in color with red colored cover plates.

2.08 GROUND BOXES

A. See Division 26 and below for additional requirements.

B. Approved manufactures are Jensen, Christy or approved equivalent.

C. All ground boxes shall have metal traffic-rated lids with permanent factory markings

Division 27/28 Ground Boxes

Item	MFG1	MFG1 P/N	MFG2	MFG2 P/N	Access Control	DIV 27/28 Pathway	Comcast	AT&T	Lid Label
10" Round Ground Box Traffic Rated Bolt Down Lid	Jensen	HTV10-5	Christy	G05	A				None
10"x17" Rectangular Ground Box Traffic Rated Metal Lid	Jensen	HT1017	Christy	B1017		B			Comm
17"x30" Rectangular Ground Box Traffic Rated Metal Lid	Jensen	HT1730	Christy	B1730		C	1	1	Comm
24"x36" Rectangular Ground Box Traffic Rated Metal Lid	Jensen	HT2436	Christy	B2436		D	2		Comm
24"x36" Rectangular Ground Box Traffic Rated AT&T	Jensen	100010927						3	AT&T
Notes:									
A – At Access Controlled Gates Requiring 2 or 3 Post Connections									
B – For Special LV Pathway Max Conduits: 2 – 1" From 3 Sides (6 Total)									
C – For LV Backbone Pathway Max Conduits: 4 – 2" From 2 Sides (8 Total)									
D – For LV Backbone Pathway Max Conduits: 4 – 2" From 3 Sides (12 Total)									
1 – 17"x30" Acceptable for Service Feed (Comcast/AT&T) Midspan Pull Box									
2 – 24"x36" Acceptable for Comcast Service Entrance Splice Box									
3 – 24"x36" Acceptable for AT&T Service Entrance Splice Box									

2.09 PENETRATION SEALING

A. Firestopping: Provide UL Listed firestopping materials for all penetrations through rated assemblies (walls / floors). See Division 07 for more information. Approved manufacturers are Hilti and Specified Technologies Inc.

B. Draft stopping: Use foam sealant around conduit penetrations (in non-rated assemblies) to prevent passage of air, smoke, and/or toxic gas. See Division 07 for more information.

C. Weatherproofing: Use weatherproof sealant around conduit penetrations in exterior walls to prevent the intrusion of water. See Division 07 for more information.

PART 3 – EXECUTION

3.01 COMMUNICATION SERVICES

A. Install inground boxes, conduits, and terminal cabinets according to the service provider requirements.

3.02 GROUNDING

A. Ground fittings shall be UL approved for each application and installed and/or connected to system in accordance with current CEC Code requirements.

B. See Division 26 for additional requirements.

C. Install one grounding bus bar per manufacturer's instructions in each MDF and IDF.

3.03 CABLE HANGER AND SUPPORTS

A. Install J-hook cable hangers and supports per manufacturer's written instructions.

B. J-hook cable hanger spacing shall be 48" or less and within 12" of sleeves and/or junction/back boxes.

C. Install J-hooks pathways perpendicular/parallel to building structure – no diagonal runs.

3.04 LOW VOLTAGE PATHWAY/RACEWAYS

A. EMT conduits may be used at following locations (see Division 26 for additional requirements):

1. In dry locations in furred spaces.
2. In partitions other than concrete or solid masonry.
3. In protected exterior locations not exposed to direct weather.

B. Rigid steel conduit and fittings shall be used for vertical risers and on top of all roofs, overhangs, walkways, canopies, or any other location exposed to direct weather. See Division 26 for additional requirements.

C. Furnish and install pull lines in all unused (empty) conduits or raceways. All pull lines shall be permanently tagged with identification at both ends.

D. Install exposed conduits neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed strut channel

supports should allow for future conduit attachments. The width of strut channel to match the width of the closest attached junction box. See design document details for attachment requirements.

F. Supports: Support conduit with two-hole straps or strut channel where shown in design documents and/or specified. Coordinate supports with architectural details. Secure to wood structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts.

G. Spacing for all EMT and rigid steel conduit supports shall be as follows, unless otherwise specified in design documents details:

1. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
   a. EMT – Size 3/4” to 2” – 4’ maximum spacing (3 each supports per 10’ conduit length) and 12” from each end of conduit at coupling, connector, or 90-degree bend.
   b. Rigid steel – Size 3/4” to 2” – 4’ maximum spacing (3 each supports per 10’ conduit length) and 12” from each end of conduit at coupling, connector, or 90-degree bend.

H. If conduit is designated for low voltage use, no more than a total of 360 degrees of conduit bend radius will be allowed between pull/junction boxes.

I. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors).

J. Clean, prep and paint with existing matching wall color all exposed conduit, junction boxes, channel strut, fittings, and accessories.

K. Non-metallic raceway to be installed with mechanical fasteners only, do not remove adhesive tape backing.

L. Capping

1. Cap conduits with manufactured seals during construction. Swab out conduits before installing wires.
2. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris; attach pull string to cap.

M. Underground Conduit

1. Service provider conduits shall be:
   a. AT&T – one ea. 4”
   b. Comcast – two ea. 2” (one spare)

2. #10 tracer wire or tracer tape is required for all underground Division 27/28 PVC conduits.

3. Before pulling any conductors into an underground PVC conduit (new or existing), the conduit shall be first be proofed by pulling through a mandrel of a diameter ¼ in. smaller than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter. IOR to witness the proofing of underground PVC conduits.

3.05 J-BOXES

A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers.

1. Boxes shall be attached to metal studs with metal box hangers.
2. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars, or clips, and be grouted in place.

B. Locate outlets at the following heights unless otherwise noted on Drawings, Specifications, current CBC, or as required to meet ADA handicap requirements.

1. Data Outlets: Same height as electrical outlets
2. Telephone Wall Outlets: Above counter/backsplash height or at electrical switch height.

C. Boxes shall be placed within 18” of electrical outlets.

D. For sound control, separate outlets on opposite sides of walls with a 16" minimum separation. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustic sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.

E. Installation of conduit and outlet boxes in fire-resistive walls, floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

3.06 GROUND BOXES

A. To be installed per Division 26 requirements.

B. Provisions are to be made for supporting cables from the box sides (i.e., j-hooks, d-rings)

C. Install a 24” x 36” ground boxes for each service providers AT&T/Comcast/other at service tie-in location.

D. Maximum underground conduit bend degrees is 360°. Additional ground boxes are required to keep conduit bends under 360°.

E. 200’ is the maximum spacing between ground boxes.

F. 17”x30” ground boxes are acceptable for mid-span pull boxes for both AT&T and Comcast.

G. 17”x30” ground boxes are acceptable for 4 – 2” conduits from a maximum of 2 sides (8 conduits total).

H. 24”x36” ground boxes are appropriate for 4 – 2” conduits from 3 sides (12 conduits total)

3.07 CONDUIT PENETRATIONS AND SLEEVES

A. PENETRATIONS:

1. Where conduit passes through walls, ceilings, or floors, with connection points to junction boxes or raceways mounted to both sides of the same wall, provide a threaded conduit and secured in place with locking rings on both sides.
2. Where the conduit passes through walls, ceilings, floors with connection points to junction boxes or raceways not mounted to the same wall as the penetration, provide EMT conduit and secured in place with strut channel.
3. Penetrations through fire rated assemblies to use EZ-Path or an approved equal fire rated sleeves.

B. SLEEVES

1. Conduit sleeves are to extend 6” past wall surface and be securely attached to the building structure, with plastic bushings on both ends.
2. Sleeves through fire rated assemblies to use EZ-Path or an approved equal fire rated sleeves and to be installed per manufacturer’s instructions.

C. FIRE STOPPING

1. Seal all conduit penetrations through fire-rated walls and floors in a manner that is fire and smoke tight in conformance with current CBC and current CEC. See Division 07 for more information.

D. DRAFT STOPPING

1. All non-fire-rated walls must be draft-stopped and sealed. Submit method to be used for approval the District’s representative Mineral wool is one product that may be used. See Division 07 for more information.

E. WEATHER SEALING

1. All exterior penetrations shall be sealed watertight. The contractor shall use silicone rubber caulk or other approved methods and materials. Submit methods and materials to the District’s representative. See Division 07 for more information.

3.08 CLEANING

A. Clean all work prior to concealing, painting, and acceptance. Performed in stages if directed.

B. Clean and repair soiled or damaged painted exposed work before final acceptance in a manner to match adjoining work.

C. Remove debris from inside and outside of equipment and enclosures.

3.09 PAINTING

A. Paint exposed conduit and j-boxes occurring in finished areas with existing matching wall color. See 09 91 00 – Painting

3.10 FINAL DOCUMENT SUBMITTALS

A. See 27 00 00 for more information.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MANUFACTURER	PART NUMBER
10" Round Ground Box Traffic Rated Bolt Down Lid	Jensen Christy	HTV10-5 G05
10"x17" Rectangular Ground Box Traffic Rated Metal Lid	Jensen Christy	HT1017 B1017
17"x30" Rectangular Ground Box Traffic Rated Metal Lid	Jensen Christy	HT1730 B1730
24"x36" Rectangular Ground Box Traffic Rated Metal Lid	Jensen Christy	HT2436 B2436
24"x36" Rectangular Ground Box Traffic Rated AT&T	Jensen	100010927
Cable tray, wire basket, ceiling mounted	Snake Tray	201 series ceiling mounted
Cable tray, wire basket, wall mounted	Snake Tray	501 series wall mounted
Cable tray, solid bottom, center hung style	MonoSystems	RTCX-XX-120-PX
Cable tray, solid bottom, wall mount style	MonoSystems	RTWX-XX-120-PX
Non-metallic Surface Raceway	Legrand/Wiremold	2300 Series
Non-metallic Surface Raceway	Legrand/Wiremold	5400/5500 Series
Floor Box (Data/Power)	FSR	FL-500P
Fire Rated Sleeve	Specified Technologies Inc.	EZ Path
Fire Rated Sealant	Specified Technologies Inc. Hilti	SpecSeal products CFS products
Conduit, Fittings, J-Boxes	Commercial grade from local electrical supply companies.	Commercial grade from local electrical supply companies.
J-Hooks	Nvent Cooper	Caddy Series B-Line Series
Grounding Bus Bar	Chatsworth Products	10622-012

END OF APPENDIX A

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable Structured Cabling communications system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) through each intermediate distribution frame (IDF) to end points requiring fiber optics and/or copper cabling and associated equipment.

B. This section condenses sections 27 11 00 – Communications Equipment Room Fittings, 27 13 00 – Communications Backbone Cabling, 27 15 00 – Communications Horizontal Cabling and 27 16 00 – Communications Connecting Cords into one comprehensive section.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Contractor shall furnish and install all required components and accessories as outlined in the design documents for a complete and operable turn-key system.
2. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the standards and requirements prior to beginning work
3. The Contractor shall furnish and install fire-treated ¾" (three quarter inch) plywood for the MDF room (all walls, from floor level to 8' high) and IDF locations (as required or indicated in the design documents).
4. The Contractor shall furnish and install a ground bus bar at the MDF and IDF rooms.
5. The Contractor shall furnish and install all required racks and cabinets.
6. The Contractor shall furnish and install all newly required conduit/raceway.
7. The Contractor shall furnish and install all wire/cable (copper/fiber optic) as required.
8. The Contractor shall terminate all strands of fiber at each fiber enclosure.
9. The Contractor shall furnish and install termination at all end-point equipment (patch panels, jacks, wallplates, enclosures, etc.).
10. The Contractor shall furnish and install all patch cords (copper/fiber).
11. The Contractor shall test and certify (for warranty) the installed cable plant.

1.03 RELATED REQUIREMENTS

A. Section 01 – General Requirements

B. Section 27 00 00 – Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

1.04 INDUSTRY GUIDELINES AND STANDARDS

A. California Electrical Code (CEC) – Current adopted version

B. California Building Code (CBC) – Current adopted version.

C. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises.

D. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.

E. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

F. ANSI/TIA 568.3-D – Optical Fiber Cabling Components Standard

G. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.

H. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.

I. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

1.05 QUALIFICATIONS

A. The contractor shall possess a California C7 or C10 license.

B. The Contractor or Subcontractor shall have 5 years' documented experience.

C. The Contractor and installers shall be certified by the product manufacturer.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.07 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

1.08 SUBMITTALS

A. See section 27 00 00 for requirements.

1.09 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

C. 25-year manufacturer's warranty/certification required for all copper and fiber cable plant installations.

1.10 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. The Contractor shall confirm all equipment part numbers with the District's representative prior to ordering equipment and updating submittals as required.

D. The Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.

E. The Contractor shall install mounting hardware and anchors as recommended by the Manufacturer of the equipment that requires mounting to the building or structure and adhere to all code requirements. See section 27 05 00 for requirements.

F. Product Availability

1. The Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 MANUFACTURERS AND PRODUCTS

A. See Appendix A at the end of this document for pre-approved materials.

B. Product Substitutions require proof of equivalence and approval by District's representative. Substitution requests to be submitted in writing.

C. For maintenance and consistency with the existing installed base, data connectivity components (copper and fiber) shall be Superior Essex cable and Ortronics connectivity.

2.03 COPPER/FIBER OPTIC CABLES AND COMPONENTS

A. All copper cables and components shall be Cat6A rated.

1. Cable to be reduced diameter. White jacket for default cable, Blue jacket for CCTV and Access Control only.
2. Jacks to be keystone style.
3. All cables shall be terminated on keystones at IDF/MDF end. No modular plug terminations are permitted at IDF/MDF locations.
4. Outside plant (OSP) Category cable is acceptable for data drops that cannot be attached to a building (i.e. AP and cameras on light poles, irrigation controllers, monuments, etc.) and must be serviced by underground conduits. Standard data drops shall not utilize OSP Category cables (unless approved by the District's representative in writing).

B. Patch cords system/color:

1. Data = White color
2. AP = Green color (2 ea. req'd at each AP)
3. CCTV = Blue color
4. Clock/Intercom = Yellow color
5. Access Control = Black color
6. Fire Alarm/Intrusion Alarm = Red color

C. Patch cord length

1. At patch panel 6" typical or no more than 12" slack.
2. Station-side patch cords to be 10' in length.

D. Data jacks system/color:

1. Data/default = White color
2. AP = Green color
3. CCTV = Blue color
4. Clock/Intercom = Yellow color
5. Access Control = Black color
6. Fire Alarm/Intrusion Alarm = Red color

E. Fiber Optic Cable:

1. Minimum strand count is 24.
2. All fiber optic cables and components shall be single single-mode OS2 rated.
3. Fiber optic cable terminations shall be LC-Duplex style.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The components making up the structure cabling system shall only be installed by Contractors who are qualified to install, service and maintain the system.

B. Cable terminations (copper or fiber) shall be installed by manufacturer-certified technicians.

C. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for accurate bidding and performance of the Work.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.

B. The Contractor shall verify the availability of power where required.

3.04 SHOP DRAWINGS

A. The Contractor shall create "Shop Drawings" per section 27 00 00 for this section.

B. Submit drawings for review and approval by the District's representative.

3.05 INSTALLATION

A. ENTRANCE FACILITIES

1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
2. Install underground or aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

B. UNDERGROUND ENTRANCE PATHWAY

1. Install the underground entrance pathway complying with Division 26.

C. EQUIPMENT RACKS, CABINETS, ENCLOSURES AND ACCESSORIES

1. Backboards:
   a. Shall be installed behind the rack or cabinet if the cabinet is not able to be directly attached to two vertical wall studs.
   b. Backboards shall be made of fire retardant or treated materials, squarely cut, and with sanded edges
   c. Backboards shall be a minimum ¾" thick and large enough to secure it to two vertical wall studs.
   d. The "FIRE RATED" stamp shall be visible.
   e. Backboards shall be fastened with ¼" lag bolt and washer, non-recessed, with maximum spacing of 18" into 2 vertical studs, 1-1/2" embedment, or otherwise per DSA-approved anchorage details.
   f. Visible portions (outside of cabinet) of Backboards shall be painted black or wall color per Architect.

2. All data & voice communications racks and cabinets shall be anchored in accordance with manufacturer's specifications, project specifications and/or drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.).
3. Securely mount equipment cabinet and racks to the building structure. A proper quantity of support fasteners shall be utilized. Typically lag bolts for wood installations, wedge anchors for concrete flooring. Submit data sheets for mounting fasteners for approval before installation. Mount equipment per DSA approved drawings/details.
4. Equipment cabinet mounted on or against walls will have 3-foot clearance in front of deepest component and accessible to rear for service.
5. MDF and all IDFs shall have at least one dedicated 120VAC 20-amp quad-receptacle each.
6. Patch Panels: Mount patch panels into the cabinet/rack. Match manufacturer of existing install or if new construction, see Appendix A.
   a. Patch panel ports shall be grouped by Room and then by System (General Data, Intercom, AP, Other). Label the patch panel with the first port of each Room.
   b. Exterior devices shall be grouped with the closest adjacent interior space.
   c. Do not segregate patch panels by system unless specifically directed on the rack elevation.

7. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radius.
8. Surge Protected Outlet Strips: Required in MDF rack. Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.

D. MDF/IDF GROUNDING

1. Refer to Section 27 05 00 Grounding for more requirements.
2. Locate the grounding bus bar to minimize the length of bonding conductors. Fasten to the wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 6 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
3. Bond metallic equipment (including ladder rack) to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.06 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's representative will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with the highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

3.07 WIRE/CABLE (COPPER/FIBER OPTIC)

A. Design, layout, size, and plan new cable runs as required.

B. All wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.

C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.

D. Neatly dress and tie (Velcro) all cabling.

E. UTP cabling shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the MDF, IDF and termination locations.

F. Fiber optic cables shall be installed from the MDF to each IDF.

G. Orange corrugated HDPE (High Density Polythylene) Innerduct shall be used for fiber optic cable protection in all interior locations.

H. Spicing of fiber optic cable shall be done with fusion splices.

I. When required copper feeders (minimum 4-pair) are to be installed from the MDF to each IDF.

J. Maintain proper bend radius for all cable installations.

K. Do not exceed cable manufacturer's instructions for installation pull load. Any cable damaged by excessive pull force shall be replaced by the installation contractor.

L. Modular plug terminated link (MPTL) style wiring is acceptable for CCTV with modified single connector permanent link testing.

3.08 LABELING

A. Correct room numbering is critical, and labels shall match room signage. The Contractor shall verify all room numbers against the approved signage submittal prior to labeling.

B. MDF/IDF - Identification number in large font on front of cabinet.

1. The MDF shall be labeled MDF 1.00
2. IDF's shall be labeled sequentially beginning at IDF 1.01, then IDF 1.02, and so on.

C. MDF, Fiber Optic LIU Ports – IDF number and room number

D. MDF/IDF, Copper Patch Panel – Panels labeled P1, P2, P3, etc., ports labeled with room number.

E. LAN Outlet – IDF number, patch panel number, patch panel port number.

F. Cables to be labeled both ends with unique identifiers and from/to location identifiers. For Copper Cat cable IDF number, patch panel number, patch panel port number.

G. T-bar ceilings shall have device labels attached next to the device for ceiling mounted equipment and at the tile for above ceiling equipment with device type and device ID points/IP address.

3.09 CONDUIT AND RACEWAY INSTALLATION

A. See Division 26 and section 27 05 00 for additional requirements.

B. Conduit bodies and any other sharp bend fittings are strictly prohibited for communications cabling (copper/fiber).

C. Install proper radius conduit sweeps where required.

3.10 FIELD QUALITY CONTROL AND TESTING

A. All Fiber and Cat6a copper cable installations to be certified by testing with an certified test system that is approved by the manufacturer for warranty certification (typically a Fluke).

B. Submit the Record Drawings (as-builts) to the District's representative for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District's representative when ready to perform a re-inspection of the installation.

F. Provide 25-year manufacturer's warranty/certification documentation for all copper and fiber cable plant installations.

3.11 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Rack Cabinet 7’ (43U), 41” Deep	Chatsworth Products	Z4-21N-113C-C12
Wall Mount Cabinet 24” (12 RU) 30” Deep *(retrofit only, not for new construction)*	Chatsworth Products	12419-724
CUBE-iT Fan Kit	Chatsworth Products	40972-001
20 AMP Power Strip	Chatsworth Products	12848-701
Standard Busbar	Chatsworth Products	10622-010
12" Ladder Rack 10'	Chatsworth Products	11275-712
Ladder Rack Triangular Support Bracket	Chatsworth Products	11746-712
Ladder Rack Wall Angle Support 12"	Chatsworth Products	11421-712
Ladder Rack Butt-Splice Kit	Chatsworth Products	11301-712
Ladder Rack Foot Kit	Chatsworth Products	11309-701
19” Horizontal Cable Manager	Ortronics	808004759
Patch Panel 24-port 1-RU (Black)	Ortronics	OR-SPKSU24
Patch Panel 48-port 2-RU (Black)	Ortronics	OR-SPKSU48
Patch Panel Cable Management Support Bar	Ortronics	OR-CMBFR0RU
Faceplate, 2-port (White)	Ortronics	KSFP2-88
Faceplate, 4-port (White)	Ortronics	KSFP4-88
Surface Mount, 2-port (White)	Ortronics	KSSMB2
Faceplate, 1-port Phone Hanger (Stainless)	Ortronics	403STJ1WP
Cat6A Data Jacks (White)	Ortronics	KT2J6A-88
Cat6A Data Jacks (Green)	Ortronics	KT2J6A-45
Cat6A Data Jacks (Blue)	Ortronics	KT2J6A-36

Cat6A Data Jacks (Yellow)	**Ortronics**	**KT2J6A-44**
Cat6A Data Jacks (Black)	**Ortronics**	**KT2J6A-00**
Cat6A Data Cable, Plenum (White = default)	**Superior Essex**	**6B-246-4B**
Cat6A Data Cable, Plenum (Blue = CCTV/Access Control)	**Superior Essex**	**6B-246-2B**
Cat6A Data Cable, Indoor/Outdoor (Black)	**Superior Essex**	**6B-272-ER**
Cat6A Data Cable, OSP (Black)	**Superior Essex**	**04-001-A8**
Extended Distance PPoE Cable, OSP	**Superior Essex**	**PW04-401-48**
Cat6A Patch Cord – for Extended Distance links only (Black)	**Monoprice**	**44669**
Cat6A Patch Cord Slim (White) (12” typ.)	**Quiktron**	**576A-RD25-0xx (xx = length)**
Cat6A Patch Cord Slim (Blue) (12” typ.)	**Quiktron**	**576A-RD10-0xx (xx = length)**
Cat6A Patch Cord Slim (Green) (12” typ.)	**Quiktron**	**576A-RD20-0xx (xx = length)**
Cat6A Patch Cord Slim (Yellow) (12” typ.)	**Quiktron**	**576A-RD15-0xx (xx = length)**
Cat6A Patch Cord Slim (Black) (12” typ.)	**Quiktron**	**576A-RD35-0xx (xx = length)**
Fiber Optic LIU 1-RU	**Ortronics, Q-Series**	**EQ01U-CHC**
Fiber Optic LIU 2-RU	**Ortronics, Q-Series**	**EQ02U-CHC**
Fiber Optic LIU 4-RU	**Ortronics, Q-Series**	**EQ04U-CVC**
Splice Tray	**Ortronics, Q-Series**	**FST4-F012 w/ mounting bracket WQS-STB**
Fiber Optic Adapter	**Ortronics, Q-Series**	**OFP-LCQ24AC**
Fiber Optic LC Field Term Connector	**Ortronics**	**205KNF9SA-09**
Fiber Optic Cable 24-strand, Single-Mode OS2, Indoor/Outdoor	**Superior Essex**	**W4024K101**

END OF APPENDIX A

END OF SECTION

SECTION 27 21 00

DATA COMMUNICATIONS NETWORK EQUIPMENT

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable data network system. The system shall provide reliable and high-performance data communication throughout the site.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Provide, coordinate, and install all required equipment, licenses, and accessories as outlined in the design documents for a complete and operable system.
2. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, utilities, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution, operation, and completion of a turn-key system to the District.
3. Data Communications Network Equipment: Includes, but is not limited to:
   a. Core Switch/Router
   b. Access Switches
   c. Wireless Access Points
   d. Licenses
   e. Uninterruptible Power Supplies (UPS)
4. Data Switches are to be programmed/configured by the contractor to the District's specifications. Contractors are responsible for retaining a Cisco-certified network engineer to complete this scope if they do not possess this capability in-house.

1.03 RELATED REQUIREMENTS

A. Division 01 - General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 - Common Work Results for Communication Systems.

D. Section 27 10 00 - Structured Cabling

1.04 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five years' experience installing data network equipment and systems.
C. Contractor shall have or retain a Cisco-certified network programmer.

1.05 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data network infrastructure.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

1.08 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.09 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
1. Cisco equipment shall be new, genuine, and obtained only from a Cisco-certified distributor. It shall carry the full Cisco standard warranty. Refurbished, remanufactured, recertified, and/or otherwise "grey" market equipment will be rejected.
2. Cisco "EDU" SKU's may not be substituted for their non-EDU equivalents. EDU products shall carry the enhanced EDU warranty, as applies.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation/operation.

D. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. The District's preferred manufacturer for:

1. Core Switch / Router - Cisco
3. Networking Switches – Cisco
4. Wireless Access Points - Cisco
5. UPS – N1C

B. Substitutions require proof of equivalence and approval by District's representative.

C. All equipment shall be provided with Licenses as required for seamless integration with the District's network infrastructure.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing data network equipment before the Bid Opening Date.

C. The Contractor shall have or retain a Cisco-certified network programmer to carry out programming the Cisco network equipment to the District's specifications.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding for the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's representative of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's representative.

C. The Contractor shall coordinate with the District's representative for needed configuration information (templates, topology, hostnames, IP addresses, etc.) at least 4 weeks prior to configuration/installation.

3.04 SHOP DRAWINGS

A. The Contractor shall create "Shop Drawings" per section 27 00 00.

3.05 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's representative will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with the highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

3.06 PATHWAY AND EQUIPMENT INSTALLATION

A. Equipment to be installed per manufacturer's instructions.

B. MDF/IDF locations with multiple switches shall utilize backplane stacking. Provide the necessary quantity of stack kits.

C. IDF locations with multiple switches shall utilize a PortChannel configuration with redundant fiber pairs back to the MDF. Provide (2) EA. SFP modules at the IDF side and (2) EA. SFP modules at the MDF side. Utilize the first fiber pair and the last fiber pair (strands 1, 2, and 23, 24) unless existing conditions require a different configuration.

3.07 EQUIPMENT COMISSIONING/CONFIGURATION

A. The Contractor shall install the equipment and patch in all connections.

B. The Contractor shall fully program and commission the network switches utilizing a District-provided configuration template. Standard commissioning includes:
   1. Updating the switch firmware to the current “golden image” as provided by Cisco.
   2. Loading the District-provided template configuration on each switch. Make appropriate updates for each switch’s unique hostname, IP address, VTP domain, and similar parameters.
   3. Identifying ports for systems requiring dedicated VLANs and configuring the ports for those VLANs.
   4. Performing basic connectivity and functionality tests.

D. Programming must be completed off-site at the Contractor’s facility or while directly connected to the equipment at the job site. VPN access will not be provided.

E. At least 4 weeks prior to system activation, provide a list of interior and exterior wireless AP MAC addresses correlated to room/location. Provide this list to the District’s representative in an electronic spreadsheet format.

F. All equipment is to be fully configured and tested for functionality by the Contractor prior to District acceptance testing.

3.08 LABELING

A. The contractor shall be responsible for labeling all newly-provided active equipment per District standard.

B. Correct room numbering is critical and labeling shall match room signage. The Contractor shall verify all room numbers against the approved door signage submittal prior to configuration/programming.

C. Network Switches

   1. ½” Label tape on front of switch, above SFP ports, with Host Name, IP address, and stack position (if applicable)
   2. Host Names shall follow the format

   <Site Code>-<IDF#>-<Location>-<Model>-<Ports>-<Stack>

   For example, Oak Ridge, IDF 1, Room A120, Cisco 9300, 48 port, two switch stack: ORIDGE-IDF1-A120-9300-48P-1-2

D. Wireless AP’s

   1. ½” label tape on center of AP, with Host Name
   2. Interior AP Host Names shall follow the format

   <Site Code>_AP_RM<location>_<last 4 of MAC address>

   Example: ORIDGE_AP_RMA101_XXXX

   3. Exterior AP Host Names shall follow the format

   <Site Code>_AP_EXTRM<location>_<last 4 of MAC address>

   Example: ORIDGE_AP_EXTRMA101_XXXX

3.09 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District's representative of readiness to perform the formal Test & Inspection of the complete system by the District's representative. Make all adjustments/changes required from District's representative review.

B. Submit the Record Drawings (as-builts) to the District's representative for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system and have personnel available with tools and equipment to inspect wiring, devices, and system operation. Also have the programmer available to make programming configuration changes.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District's representative when ready to perform a re-inspection of the installation.

3.10 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Network Switch	Cisco	C9300L-48UXG-4X-EDU
Network Switch License (DNA Essentials, 48-port, 3-yr)	Cisco	C9300-DNA-E-48-3Y

Network Switch Secondary Power Supply	Cisco	PWR-C1-1100WAC-P
SFP transceiver	Cisco	SFP-10G-LR
Stack Kit (9300 to 9300)	Cisco	C9300L-STACK-KIT
Stack Extended Cable (IDF's with 3+ switches)	Cisco	STACK-T3A-1M
DAC Cable (9300 to previous gen switch; not common)	Cisco	SFP-H10GB-CU1M
Core Switch (sites with 11 or fewer IDFs)	Cisco	C9500-24Y4C-EDU
Core Switch (sites with 12 or more IDFs)	Cisco	C9500-48Y4C-EDU
Core Switch License (DNA Essentials, 3-yr)	Cisco	C9500-DNA-E-3Y
Core Switch Power Supply	Cisco	PWR-C4-950WAC-R
Wireless Access Point (Interior) (note: includes low-profile bracket and ceiling grid clip)	Cisco	C9130AXI-B
Ceiling Mount Bracket (Low-profile) for C9130AX	Cisco	AIR-AP-BRACKET-1
Ceiling Mount Bracket (Universal/ Electrical Box) for C9130AX	Cisco	AIR-AP-BRACKET-2
T-bar Mount Bracket (Recessed Tiles) for C9130AX	Cisco	AIR-AP-T-RAIL-R
T-bar Mount Bracket (Flat Tiles) for C9130AX	Cisco	AIR-AP-T-RAIL-F
Wireless Access Point (Exterior/Surface)	Cisco	C9124-AXE-B with 4 Ea. AIR-ANT2568VG
Wireless Access Point (Exterior/ with Oberon)	Cisco	C9124-AXI-B
Wall/Pole Mount for C9124-AXI-B	Cisco	MNT-VERT1
Exterior AP Enclosure	Oberon	1021-00
UPS (MDF 4-post) with network monitoring and external battery (2000VA, 50AH) 120VAC input	N1C	N1C.LR2000, N1C.L4850EBM2U (For 2 post rack mount only - add N1C.24RAILKIT)
UPS (MDF 4-post) with network	N1C	N1C.LR2000G, N1C.L4850EBM2U

monitoring and external battery (2000VA, 50AH) 208-240VAC input		(For 2 post rack mount only - add N1C.24RAILKIT)
UPS (IDF) with network monitoring (1000 VA) 120VAC input	N1C	N1C.L1000
UPS (IDF) with network monitoring (1500 VA) 120VAC input	N1C	N1C.L1500
UPS (IDF) with network monitoring (2000 VA) 120VAC input	N1C	N1C.L2000

END OF APPENDIX A

END OF SECTION

SECTION 27 30 00

VOICE COMMUNICATIONS

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Voice Communications system.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Voice Communication system to the District.
2. The contractor will coordinate with the District's representative in writing for any needed information (i.e. IP addresses, etc.) 10 business days prior to date the information is needed.
3. Voice Communication system equipment: Includes, but is not limited to:
   a. VoIP Phone Sets
   b. VoIP 5G Gateway
4. VoIP Phone Sets are to use District standard network cabling, see Section 27 10 00.

1.03 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing Voice Communication system where applicable.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

1.08 CONTRACTOR “SHOP DRAWINGS” DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

1.09 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five (5) years’ experience installing communications equipment systems.

1.10 CERTIFICATIONS

A. See section 27 00 00 for requirements.

1.11 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District’s representative will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturers – The District's IP Phone equipment is Cisco. See Appendix A at the end of this document for pre-approved materials.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
1. Cisco equipment shall be new, genuine, and obtained only from a Cisco-certified distributor. It shall carry the full Cisco standard warranty. Refurbished, remanufactured, recertified, and/or otherwise "grey" market equipment will be rejected.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. The Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into their proposed Contract Time.
2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and prior approval by District's representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing electronic clock equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's representative of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's representative.

C. Submit and receive approval for shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

A. See Division 26 and Section 27 05 00 for requirements and more information.

B. Existing Construction:

1. Refer to design documents.

3.05 EQUIPMENT INSTALLATION

A. Equipment to be wired and installed per manufacturer's instructions.

B. Wall mounted VoIP Phone sets are to have a data drops to be installed inside flush single-gang back box at the location shown on the design documents (typically to the righthand side of the teaching wall).

C. Desktop VoIP Phone sets are to plugged into an appropriate location standard data connection.

3.06 CONFIGURATION

A. VoIP Phone sets will be programmed by the District after they are physically installed in the rooms and network connectivity is active. Notify the District's representative when phones have been installed and are ready for programming.

3.10 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District's representative of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to the District's representative for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District's representative when ready to perform a re-inspection of the installation.

F. District's representative to provide final sign-off for acceptance.

3.11 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Standard IP Phone	**Cisco**	**DP-9841-K9=**
Advanced IP Phone	**Cisco**	**DP-9861-K9=**
Wall Mount Kit for Cisco 9800 Series IP Phones	**Cisco**	**DP-9800-WMK=**
Wall Hanger Kit (for standard 2-post phone hanger plate)	**Slicshop**	**9800-BRKT-STN**
Conference Room IP Phone	**Cisco**	**CP-7832-3PCC-K9=**
Analog to IP Adapter (ATA)	**Cisco**	**ATA192-3PW-K9**
5G Cellular Gateway (Internal Antenna)	**Meraki**	**MG52-HW**
5G Cellular Gateway (External Antenna)	**Meraki**	**MG52E-HW**
5G Cellular Gateway External Antenna	**Meraki**	**MA-ANT-DUAL-C3**
3-Year Enterprise License for 5G Cellular Gateway	**Meraki**	**LIC-MG52-ENT-3Y**

END OF APPENDIX A

END OF SECTION

SECTION 27 51 23.50

EDUCATIONAL INTERCOM SYSTEMS

PART I – GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Intercom/Public Address/Bell system. This system shall provide the ability to bi-directionally communicate with an individual room, broadcast to defined speaker zone(s) and ring bell tones on a predefined schedule. For sites that utilize the small message board, this section will supplant the use of section 27 53 13 Clock Systems.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Assistive Listening system to the District.
2. The contractor will coordinate with the District's representative in writing for any needed information (i.e. IP addresses, etc.) 10 business days prior to the date the information is needed.

B. The District has standardized on Rauland Telecenter U equipment and the installing Contractor shall be Rauland Telecenter authorized.

C. For existing construction – provide and install all components and accessories to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing campus' system. Prior to beginning any work, the Contractor is responsible for identifying any existing system errors or faults and bring these issues to the attention of the District's representative.

D. The Contractor shall be responsible for programming the Rauland Telecenter Intercom System.

E. The Contractor shall coordinate with site staff for Bell schedule programming requirements.

F. The Contractor shall review the proposed final system programming, functionality and expectations with the District's representative prior to final programming.

G. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the inspector of record (IOR) and/or the District's representative.

H. The Contractor shall adjust any speaker levels to the appropriate level as determined in system testing.

I. Existing systems shall remain operable until the new system is accepted and approved by the District's representative.

J. The Contractor is responsible for user/operator training (maximum 2 hours).

K. The Contractor shall complete all required project closeout documentation in a timely fashion.

J. The Contractor shall provide and install hardware required for the interoperability with other systems (i.e. Fire Alarm, Intrusion Alarm, Electronic Access Control, Mecho Shades, etc.).

1.03 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 27 00 00 – Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing intercom system when applicable.

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

A. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five (5) years' experience installing Rauland Telecenter equipment.

C. The contractor shall possess a California a C7 or C10 license.

D. The Contractor or Subcontractor shall be Rauland Telecenter authorized to provide and install equipment with 5 years documented experience.

1.10 CERTIFICATIONS

A. Installers for this project shall be manufacturer certified.

1.11 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's representative will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. The Contractor shall comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. The Contractor shall perform the "Work" with persons experienced and qualified to produce the high-level workmanship specified.

E. The Contractor shall maintain quality control over suppliers and Subcontractors.

F. The Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. The approved manufacturers for the project are:

1. Control unit and related accessories: Rauland Telecenter U
2. Speakers: See Appendix A for different installation types
3. Wire, cable, and accessories: See Appendix A.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. The Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and prior approval by District 's representative before ordering.

C. Main system components:

1. Rauland Telecenter U IP Campus Controller and software
2. Rauland Telecenter U Auxilliary Input/Output Module
4. Rauland Telecenter U IP Classroom Module
5. Rauland Telecenter U Administrative Console
6. Rauland Telecenter U Program Line Input Module

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified and certified by the manufacturer to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing educational intercom equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's representative of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's representative.

C. The Contractor shall submit and receive approval for shop drawings prior to work commencement.

D. The Contractor will coordinate with the District's representative in writing for any needed information (i.e. IP addresses, etc.) at least 3 weeks prior to date the information is needed.

3.04 PATHWAY INSTALLATION

A. See Division 26 and Section 27 05 00 for requirements and more information.

B. Existing Construction:

1. Refer to design documents.
2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

A. Equipment to be wired and installed per manufacturer's instructions.

B. The Contractor shall coordinate with the District's representative and provide a spreadsheet of all device MAC addresses indexed by device location for the programming of reserved IP addresses for each device.

C. Installation shall be in accordance with applicable codes (i.e. NEC, NFPA 72) local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

D. Perform all Work as indicated in the Drawings and Specifications.

E. All low voltage cables shall be kept away from power circuits.

F. Contractor shall provide programming and configuration of the Educational Intercom system for full functionality.

G. Contractor shall maintain a complete, up-to-date backup of the system configuration. Backup shall be maintained throughout the programming period until final Acceptance by the District's representative. Submit back-ups to the District's representative upon Final Acceptance.

3.06 LABELING/SCHEDULES

A. The Contractor shall verify all room numbers against the approved signage submittal prior to labeling.

B. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

C. Label all standard speaker cables with port ID.

D. Label all speakers with speaker ID.

E. Label all IP speakers with MDF/IDF, patch panel and jack numbers.

3.07 CONFIGURATION

A. All equipment to be fully configured and tested for functionality prior to testing.

B. Correct room numbering is critical for configuration/programming and labeling shall match room signage. The Contractor shall verify all room numbers against the approved signage submittal prior to configuration/programming.

3.08 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District's representative of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to the District's representative for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District's representative when ready to perform a re-inspection of the installation.

F. The District's representative to provide final sign-off for acceptance.

3.09 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

B. As-built riser diagram showing all access control components for site.

3.10 TRAINING

A. For new systems provide 8-hrs end-user training.

B. For existing system upgrades provide 2-hrs end-user training.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
IP Campus Controller and software/licenses	Rauland Telecenter U	TCC2000
Administrative Console	Rauland Telecenter U	TCC2045
Auxiliary Input/Output Module	Rauland Telecenter U	TCC2033
Universal Rack Mounting Kit	Rauland Telecenter U	TCC2099
Program Line Input Module	Rauland Telecenter U	TCC2055
Zone page amplifier (25V, 14W/35W)	Rauland Telecenter U	Amplifier: TCC3022 Power Supply (over 14W): TCC3022PS
IP Classroom Module	Rauland Telecenter U	TCC2011B
Zone Page Module (used with external audio amplifier)	Rauland Telecenter U	TCC2022
Audio Power Amplifier (25V, 2x160W)	Powersoft	MEZZO 322A
8-Ohm 2'x2' Lay-in Ceiling Speaker, RJ-45 (common areas / hallways)	Rauland	BAFKIT2X2L8RJ Add: IP Classroom module
8-Ohm 8" Speaker assembly surface (retrofit)	Rauland	- Speaker USO880 - Backbox ACC1112 - Baffle ACC1003 - Add: IP Classroom module
8-Ohm 8" Speaker assembly flush (new construction)	Rauland	- Baffle w/speaker ACC1480 - Backbox ACC1000 - Add: IP Classroom module
25V 8" Speaker assembly flush (new construction restrooms)	Rauland	- Baffle w/speaker ACC1400 - Backbox ACC1100
Clock/Speaker surface combo (standard classroom/office retrofit)	Rauland	- Baffle w/ Speaker ACC3011S - Backbox ACC3011SBB - Message Board TCC3011S Add: IP Classroom module
Clock/Speaker flush combo (standard classroom/office new construction)	Rauland	- Backbox ACC3011FBB - Baffle w/speaker ACC3011S - Message Board TCC3011S Add: IP Classroom module
Exterior Speaker (retrofit)	Rauland Lowell Rauland FSR	Backbox: ACC1113 Baffle: ACC1012 Speaker: 8C10MRB Interior Backbox SMWB-4G-WHT - Add: IP Classroom Module (single

		speaker up to 2W) **Add: Wire breakout 603101 (when IP module used)**
Exterior Speaker (new construction)	**Lowell** **Rauland** **Rauland** **FSR**	**Speaker 8C10MRB** **Baffle ACC1012** **Backbox ACC1105** **Interior Backbox 4-gang generic** - **Add: IP Classroom Module (single speaker up to 2W)** - **Add: Wire breakout 603101 (when IP module used)**
Large Message Board (Clock)	**Rauland**	**TCC3012L**
Wire Guard for Large Message Board	**American Time**	**G2055OF-28**
Speaker, Exterior (25V)	**Lowell**	**Speaker: 8C10MRB-T72**
UPS (Telecenter Head End)	**N1C**	**N1C.L1500**
25V Speaker Cable	**West Penn**	**292**

END OF APPENDIX

END OF SECTION

SECTION 27 51 26

ASSISTIVE LISTENING SYSTEMS

PART I - GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Assistive Listening system. The system shall be provided in each assembly area, including conference and meeting rooms, in accordance with ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010 section(s) 216.10, 219, 706, and CBC section(s) 11B-216.10, 11B-219, 11B-706.

1.02 SCOPE

A. The work will include but not be limited to the following objectives:

1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Assistive Listening system to the District.
2. The contractor will coordinate with the District's representative in writing for any needed information (i.e. IP addresses, etc.) at least 2 weeks prior to date the information is needed.

B. The Assistive Listening System shall be FM (72 MHz) for large venue systems, and IR for classroom and portable systems.

C. Assistive Listening equipment: Includes, but is not limited to:

1. Transmitters
2. Receivers
3. Earpiece/Neck loops
4. Chargers
5. Signs

D. Typical installation includes a transmitter with audio source input or microphone and portable rechargeable receivers with either neck loops or earpieces.

E. Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive-listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive-listening system shall be provided.

F. The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing aid compatible.

G. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neck loops.

H. Classroom assistive listening systems shall be fully integrated with the classroom audio-visual system or mobile TV cart such that program audio is provided via the assistive listening system.

1.03 RELATED REQUIREMENTS

A. Division 01 – General Requirements

B. Section 27 00 00 - Communications

C. Section 27 05 00 – Common Work Results for Communication Systems.

D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing A-V system

1.07 SUBMITTALS

A. See section 27 00 00 for requirements.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

B. Five (5) years' experience installing Assistive Listening/AV equipment systems.

1.10 CERTIFICATIONS

A. See section 27 00 00 for requirements.

1.11 WORKMANSHIP

A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.

B. The District's representative will have the authority to reject Work which does not conform to the Drawings and Specifications.

C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

D. Perform Work with persons experienced and qualified to produce workmanship specified.

E. Maintain quality control over suppliers and Subcontractors.

F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturers – The District has standardized on Listen Technologies.

B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The contractor shall provide all components needed for complete and satisfactory installation and operation.

D. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

A. See Appendix A at the end of this document for pre-approved materials.

B. Substitutions require proof of equivalence and prior approval by District's representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.

B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing electronic assistive listening equipment before the Bid Opening Date.

3.02 EXAMINATION

A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's representative of long lead time items.

B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's representative.

C. Submit and receive approval for shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

A. See Division 26 and Section 27 05 00 for requirements and more information.

B. Existing Construction:

1. Refer to design documents.
2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

A. Equipment to be wired and installed per manufacturer's instructions.

B. BASE TRANSMITTER (provide 1 for each permanent sound system).

1. Provide base transmitter with rack mount kit. Install where specified in the sound equipment rack and connect to content source.
2. Install antenna where specified and cabling from the Base Transmitter to the antenna location.
3. Program the transmitter to an interference-free transmit frequency in coordination with any adjacent systems

C. RECEIVERS (provide a quantity equal to or greater than 4% of the total number of seats, but in no case less than 2)

1. Install rechargeable batteries, if applicable
2. Program receivers to the broadcast frequency of the Base Transmitter

D. SIGN

1. Provide Assistive Listening System sign per ADA requirements to indicate equipment available for the hearing impaired. Verify location with the architect prior to installation. Submit sample for approval. The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance, or ticket booth window as applicable. Verify location with architect prior to installation. Assistive listening signs shall include the International Symbol of Access for Hearing Loss.

E. PORTABLE SYSTEMS

1. The Contractor shall provide programming and configuration for each Assistive Listening System portable system to ensure interference-free operation between adjacent systems.

3.06 LABELING/SCHEDULES

A. The Contractor shall verify all room numbers against the approved signage submittal prior to labeling.

B. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

C. Cables shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF, etc.) and as they enter or exit and conduit pathway.

3.07 CONFIGURATION

A. All equipment to be fully configured and tested for functionality prior to testing.

3.08 FIELD QUALITY CONTROL AND TESTING

A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District's representative of your readiness to perform the formal Test & Inspection of the complete system.

B. Submit the Record Drawings (as-builts) to the District's representative for review prior to inspection.

C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.

D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

E. Notify the District's representative when ready to perform a re-inspection of the installation.

F. The District's representative to provide final sign-off for acceptance.

3.09 AS-BUILT DRAWINGS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Portable ListenIR System	**Listen Technologies**	**LS-88-01**
Multi Purpose Room Components:		
Assistive Listening Base Transmitter (72MHz)	**Listen Technologies**	**LS-800-072-01**
Receivers (72 MHz)	**Listen Technologies**	**LR-4200-072**
Ear Speaker	**Listen Technologies**	**LA-401**
Neck Loop	**Listen Technologies**	**LA-430**
Universal Antenna Kit	**Listen Technologies**	**LA-122**
Universal Rack Mounting Kit	**Listen Technologies**	**LA-326**
Assistive Listening Notification Signage Kit	**Listen Technologies**	**LA-304**
RG-8 50 ohm Coaxial Cable	**Listen Technologies**	**LA-113**
RG-8 BNC connector	**Listen Technologies**	**LA-128**
12 unit charging tray	**Listen Technologies**	**LA-381**
3U rack drawer	**Middle Atlantic**	**D3**

END OF APPENDIX A
END OF SECTION

SECTION 28 46 00

FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies equipment, accessories, wire, materials, installation, configuration and testing requirements for a complete and operable Fire Detection and Alarm system. The system shall provide fire alarm detection, notification, monitoring, command, and control and be connected to the District's existing UL listed monitoring station. New construction shall be Emergency Voice Alarm Communication (EVAC) compliant.

1.02 SCOPE

A. The installed Fire Alarm system shall comply with all requirements of currently adopted version of NFPA 72.

B. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work.

C. For new building construction on an existing campus – provide and install all components and accessories as outlined in the design documents for a complete and operable system that extends and seamlessly integrates into the existing campus' Fire Alarm system.

D. For construction in existing buildings - provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing campus' Fire Alarm system. Prior to beginning any work, the Contractor is responsible for identifying any existing system errors or faults and bring these issues to the attention of the District's representative.

E. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation, and completion of the Work

F. Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.

G. The Contractor shall be responsible for programing of all Fire Alarm Control Panel(s) (FACP) site wide.

H. With one-week notice the Contractor shall coordinate with the District's representative staff for monitoring connectivity.

I. Prior to final programming the contractor shall review the proposed final system programming, functionality and expectations with the District's representative. If the system is programmed

without approval, all subsequent requested programming changes by the District's representative will be at the Contractor's expense.

J. After completion of the installation and 100% pretest of the system, a satisfactory final test (compliant with NFPA 72 requirements) of the entire system shall be made in the presence of the inspector of record (IOR) and the District's representative.

K. Provide the District's representative with an electronic copy of final test results.

L. Existing system shall remain operable until new system is accepted and approved by the IOR and the District's representative.

M. The Contractor is responsible for user/operator training (2 hours).

N. The Contractor shall complete all required project closeout documentation in a timely fashion.

O. A single speaker/strobe notification appliance may be used for both Fire alarm and CO detection notification. However, the device shall NOT have the word "FIRE" and requires a distinct temporal (3 or 4) coding with distinct voice notification (see DSA IR 9-2 for more information).

P. Integration with the site Intercom system for fire alarm activation notification.

1.03 RELATED REQUIREMENTS:

A. Division 01 – General Requirements

B. Division 26 – Electrical

C. Section 27 00 00 – Communications

D. Section 27 05 00 – Common Work Results for Communication Systems

1.05 CODES AND STANDARDS:

A. The installed system shall conform to all California State Codes

1. 2025 California Building Code (CBC)
2. 2025 California Electrical Code (CEC)
3. 2025 California Fire Code (CFC)
4. All equipment shall have California State Fire Marshall listing(s)
5. DSA IR 9-1 Emergency Voice/Alarm Communication Systems
6. DSA IR 9-2 Carbon Monoxide Detection Requirements for Group E Classrooms and Group I-4 Occupancies

B. National Fire Protection Association (NFPA) - USA:

1. 2020 NFPA 70 - National Electric Code (NEC)
2. 2022 NFPA 72 - National Fire Alarm Code (NFPA 72)
3. 2021 NFPA 101 - Life Safety Code (NFPA 101)
4. Americans with Disabilities Act (ADA)

C. Local building codes

D. All requirements of the Authority Having Jurisdiction (AHJ)

1.06 UNDERWRITERS LABORATORY (UL) LISTING

A. All equipment shall be UL listed for its intended purpose.

B. Any modification that voids the equipment's UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).

C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.

1.07 QUALIFICATIONS:

A. The Contractor shall possess a California C10 license.

B. The installation Contractor or Subcontractor shall be FACP manufacturer authorized to provide and install equipment with 5 years of documented experience.

C. The programming technician shall possess a valid manufacturer's programming certification.

D. The Contractor shall have at least one NICET certified in Fire Alarm Technology, level II (or greater) personnel as the on-site supervising technician who is always on site when Fire Alarm activities are taking place.

E. The installation company and its subcontractors shall have an office located within 50 miles of the project site.

1.07 REFERENCES

A. See Section 27 00 00

1.08 SYSTEM REQUIREMENTS

A. Site Compatibility

1. Any new installations or modifications to an existing system shall seamlessly integrate into the site's existing Fire Alarm system.

1.09 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See Section 27 00 00 for requirements.

B. Shop Drawings are required for this project.

1.10 SUBMITTALS

A. See Section 27 00 00 for requirements.

B. Provide copies of certificates listed in the QUALIFICATIONS section above.

1.11 WARRANTY

A. Refer to Division 01 Warranty section.

B. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL:

A. The District preferred fire alarm control panel manufacturers are FireLite for Elementary and Notifier for Middle and High Schools.

B. See Appendix A for pre-approved equipment listings.

C. All products shall be new and unused and shall be of manufacturer's current and standard production.

D. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.

E. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory system operation.

F. Product availability:

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Certain products specified may only be available through factory authorized dealers and distributors. The Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

G. In compliance with DSA IR 9-2 for CO Detection, in areas where CO detection is needed EVAC notification appliances will be utilized for Fire Alarm and Carbon Monoxide alerts, promoting a building wide evacuation. For this reason, interior notification appliances (Speaker/Strobes) shall not have the word “FIRE” on the device.

2.02 CONDUIT AND RACEWAY

A. See Section 27 05 00 for conduit and raceway requirements.

2.03 WIRE AND CABLE

A. Provide all new wire and cable required to install systems as indicated on design documents or approved shop drawings.

B. Approved wire and cable manufacturer is West Penn, substitutions require prior approval.

C. All cable shall be jacketed, and jacket color shall be red (OSP cable excluded). No THHN/THWN allowed.

D. All cables shall be specifically designed for their intended use and install requirements (FPL, plenum, direct burial, aerial, etc.).

E. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG solid for initiating device circuits and signaling line circuits, 12 AWG stranded for notification appliance circuits and 14 AWG stranded for emergency voice communication circuits. (Coordinate with wire schedule)

2.05 BATTERIES

A. Shall be new 12-volt, sealed lead-acid type.

B. Battery shall be sized according to calculations on design drawings.

C. Approved battery manufacturer: Powersonic or approved equal

2.06 EXTRA STOCK:

A. For projects with less than 10 new Fire Alarm devices – no extra stock required.

B. For projects with 11 – 50 new Fire Alarm devices – provide extra stock of 1 (ea.) Smoke detector (current model), 1 (ea.) Heat detector (current model) and 1 (ea.) Pull station (current model)

C. For projects over 50 new Fire Alarm devices – provide extra stock of 2 (ea.) Smoke detector (current model), 1 (ea.) CO detector (current model), 1 (ea.) Wall speaker/strobe (current model) and 1 (ea.) Ceiling speaker strobe (current model) per 100 Fire Alarm device increments.

D. For projects over 300 new Fire Alarm devices – provide devices listed in sections C (above) plus 1 (ea.) Power Booster (current model)

PART 3 – EXECUTION

3.01 INSTALLATION:

A. The installing company shall employ a minimum of one National Institute for the Certification in Engineering Technologies (NICET) Fire Alarm Systems, level II technician. To ensure system integrity, the NICET level II technician shall be on site during all fire system related work to guide the installation of conduit, back-boxes, device placement, device installation, programming, pre-testing, and final testing of the system.

B. The District's representative and/or Inspector of Record (IOR) shall have the authority to stop work until the certified personnel requirement is met. The Contractor shall be held accountable for meeting completion dates.

C. Installation shall be in accordance with the CBC, CEC, CFC, NFPA 72, local and national codes.

D. Fire Alarm cables shall not be installed in decking flutes as pathway. Any conduit that needs to be located in decking flutes needs to be rigid.

E. All Fire Alarm cables shall be run unexposed (not observable from occupiable space) throughout the entire cable path – either in conduit, on ladder racking, on J-hooks above ceilings or below flooring. Cable runs on J-hooks shall be perpendicular/parallel to building structure – no diagonal runs.

F. All fire devices and panels shall be mounted at the heights indicated on the design plans and shall comply with local, CBC, CEC, CFC, and NFPA 72 codes and standards. Any code discrepancies shall be brought to the Designer/Engineer and District's representative attention.

G. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place with fasteners and supports in accordance with drawings and specifications.

H. Signal line circuits (SLC) for initiating devices shall be wired Class B.

I. Notification appliance circuits (NAC) shall be wired Class B.

J. CO detection to initiate a building-wide evacuation in accordance with DSA IR 9-2.

K. Smoke detectors shall remain covered until operational. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and/or physical damage and may require additional testing and/or replacement.

L. All addressable smoke or heat devices shall have point-id labels (see 3.02 LABELING).

M. All modules with indicator lights (i.e., Monitor Modules & etc.) shall be mounted where the indicator lights are observable from the occupiable space.

N. Smoke relief hatches are to have door contacts installed and monitored with a monitoring module. The opening of the hatch shall produce a Supervisory event notification. Monitoring module height is to be 10’ AFF or less.

O. Fire alarm circuits shall have a red breaker lock on device per NFPA 72 requirements.

P. All modifications to electrical power shall be made by a licensed electrician.

Q. Headend FACP and associated equipment layout per design documents. If no layout exists Contractor to notify and receive guidance from the District’s representative prior to install.

R. All Duct Smoke Detector / Fire Smoke Damper shutdown to be coordinated with Div 23.

S. The contractor will coordinate with the District’s representative in writing for any needed information (i.e. IP addresses, etc.) at least 4 weeks prior to date the information is needed.

3.02 LABELING

A. The Contractor shall verify all room numbers against the approved signage submittal prior to labeling.

B. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

C. Device ID Labels are to be 1/4” lettering for mounting heights 10’ AFF or less, 1/2" black lettering on white labels for mounting heights greater than 10’ AFF.

D. All panels and power supplies shall be labeled indicating AC electrical power panel and circuit breaker number and panel location.

E. All panels and power supplies shall be identified per design plans.

F. All smoke and heat detectors shall be labeled with Point ID affixed to the trim skirt. Labels are to be visible when approaching the device from the room entry.

G. All modules are to be labeled with Point ID and function and/or associated equipment (i.e., FAN SHUTDOWN, HVAC UNIT XX, ATTIC HEAT, etc.)

H. All notification devices shall be labeled with NAC Point ID.

I. All cables in cabinets shall be labeled with function and circuit ID.

J. All end-of-line devices shall have a “EOL” label.

3.03 PANEL PROGRAMMING/SOFTWARE MODIFICATION

A. Correct room numbering is critical for configuration/programming and labeling shall match room signage. The Contractor shall verify all room numbers against the approved signage submittal prior to configuration/programming.

B. The contractor shall review the proposed system programming, functionality, expectations with the District's representative 10 days prior to final programming.

C. The Contractor shall provide the services of a factory trained, and authorized technician to perform all system software modifications, upgrades, or changes on site. No remote programming is allowed.

D. The Contractor shall provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system.

E. Programming syntax shall be consistent with the existing site for label text and numbering scheme.

3.04 PRE-TESTING

A. The entire system shall be checked and pre-tested by the Contractor and shall test free of all faults prior to calling for a final test.

B. Before energizing the cables and wires, check for correct connections and test for open circuits, short circuits, ground faults, continuity, and any physical damage to the cable/wire insulation that may have occurred during installation.

3.05 TESTING AND GUARANTEE

A. Upon completion of the installation of the system, a test consisting of 100% of all newly installed and 10% of existing relevant system components shall be performed to confirm operation and function. This test shall be done in the presence of the Inspector of Record (IOR) and the District's representative.

B. Provide the District's representative with 7 days in advance written notice of system readiness for Final Testing and Inspection. The system shall be 100% pre-tested and fully operable with no trouble conditions prior to final test.

C. Provide the service of a NICET level II technician to supervise and participate in all of the adjustments and/or testing of the system.

D. Testing and adjustments – the Contractor shall:

1. Verify that all devices operate per Design documents matrix (matrices).
2. Verify the Point IDs and descriptions as indicated on the updated (redlined) Design Documents Floor Plan.
3. Verify the candela settings of all NAC devices with strobes.
4. Verify the intelligibility for all EVAC notification appliance speakers.
5. Verify and document that sound levels at all EVAC notification appliance speakers meet or exceeds the minimum sound levels as indicated in the design drawings for expected average

ambient or maximum sound levels. Testing to be conducted using dBA setting, 5’ above finished floor and 10’ from speaker with a stand-alone meter (Galaxy Check Mate series or equal).

6. Contractor to adjust speaker wattage settings as required to meet sound levels required after testing.
7. Verify proper alarm and trouble of all sprinkler system flow valve(s).
8. Verify that an open circuit on the initiating device circuit activates a trouble signal locally for all circuits.
9. Verify that an open or a short circuit on the signaling line circuit activates a trouble signal locally for all circuits.
10. Verify that an open or short circuit on the notification appliance circuit activates a trouble signal locally for all circuits.
11. Verify that a ground condition on an initiating device circuit activates a trouble signal locally for all circuits.
12. Verify that a ground condition on a signaling line circuits activates a trouble signal locally for all circuits.
13. Verify that a ground condition on a notification appliance circuit activates a trouble signal locally for all circuits.

3.06 DEMOLITION

A. See section 27 05 00, for requirements

3.07 FINAL DOCUMENT SUBMITTALS

A. See section 27 00 00, for additional requirements

B. Submit completed NFPA certification forms as found in NFPA 72. Forms shall be submitted in typewritten format.

C. Provide the District’s representative with an electronic copy of final test results.

D. Contractor “red-line as-built” drawings shall also include the following: The drawings shall depict, at a minimum, the following conditions:

1. The device exact installed location.
2. Device updated labeling ID(s), which shall match the physical label at the device.
3. Revised risers to match record set point to point installation and
4. Updated battery calculation with quantity of device changes.
5. New pathways, conduit, ground boxes, junction boxes, raceway, power-poles and floor-monuments.
6. Any other new conditions.

E. The Contractor shall submit “red-line as-built” drawings as indicated on project schedule.

F. Warranty:

1. Refer to Division 01 Warranty section.

2. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day “burn-in” period shall begin. Any fault shall reset the “burn-in” period to zero (0). Warranty shall commence at day 31 of a successful and continuous “burn-in” period.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Fire Alarm Control Panel	**Fire-Lite**	**ES-1000X 954-PT**
Voice EVAC Control Panel	**Fire-Lite**	**ECC-50/100**
Remote Fire Annunciator	**Fire-Lite**	**LCD-80F**
Smoke Detector	**Fire-Lite**	**SD365**
Heat Detector (Rate of Rise)	**Fire-Lite**	**H365R**
Heat Detector (Non-addressable)	**System Sensor**	**5602**
CO Detector	**Fire-Lite**	**SD355CO**

Pull Station	**Fire-Lite**	**BG-12LX**
Monitor Module (Single)	**Fire-Lite**	**MMF-300**
Monitor Module (Dual)	**Fire-Lite**	**MDF-300**
Monitor Module (Mini)	**Fire-Lite**	**MMF-301**
DACT	**Fire-Lite**	**DACT-UD2**
Remote Amplifier	**Fire-Lite**	**ECC-50DA**
Remote Microphone	**Fire-Lite**	**ECC-RM**
Booster Power Supply	**Fire-Lite**	**FCPS-24FS6**
Horn/Strobe (Wall)	**System Sensor**	**P2RL**
Horn/Strobe (Ceiling)	**System Sensor**	**PC2RL**
Horn (Outdoor)	**System Sensor**	**HRK**
Speaker/Strobe (Wall)	**System Sensor**	**SPSRL**
Speaker/Strobe (Ceiling)	**System Sensor**	**SPSCRL**
Speaker (Outdoor)	**System Sensor**	**SPRK**
Duct Smoke Detector	**System Sensor**	**D4120**
Test Switch	**System Sensor**	**RTS-151-KEY**
Terminal/Barrier Strip	**Ideal Industries**	**89-608**
Dry Contact Input Relay	**Functional Devices, Inc.**	**RIB01BDC**
Fire Alarm Control Panel	**Notifier**	**NFS2-3030**
Voice EVAC Control Panel	**Notifier**	**NFC-50/100**
Smoke Detector	**Notifier**	**FSP-951**
Heat Detector (Rate of Rise)	**Notifier**	**FST-951**
CO Detector	**Notifier**	**FSCO-951**
Smoke/CO Detector	**Notifier**	**FCO-951**
Pull Station	**Notifier**	**NBG-12LX**
Monitor Module	**Notifier**	**FMM-1**
Monitor Module (Mini)	**Notifier**	**FMM-101**
Control Relay	**Notifier**	**FRM-1**
Isolator Module	**Notifier**	**ISO-X**
Remote Power Supply	**Notifier**	**PSE-6**
Heat Detector (194°/Rate of rise, Conventional)	**System Sensor**	**5602**

Heat Detector (194°/Rate of rise, Conventional) mounting plate	**Potter/Thermotech**	**302-194, AP-P**
Heat Detector (135°/Rate of rise, Conventional Threaded)	**Potter/Thermotech**	**302ET-135**
Universal Dual Path Communicator	**Bosch**	**B465**
Cellular Dialer	**Telguard**	**TG-7FM**

END OF APPENDIX A

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

2. Section 01 50 00, Construction Facilities and Temporary Controls.

3. Section 32 16 00, Site Concrete.

1.02 SUBMITTALS

A. Refer to Section 01 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.03 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.

D. Tests (See Part 3 for Compaction Testing).

E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.04 WARRANTY

A. Refer to General Conditions and Section 01 78 36.

1.05 REFERENCES AND STANDARDS

A. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.

B. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

C. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

E. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

F. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

G. CALTRANS Standard Specifications Section 17.

H. CAL-OSHA, Title 8, Section 1590 (e).

I. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 EXISTING SITE CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered

during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.09 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

A. Underground Utility Locating:

1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
   a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
   b) All conduit pathways containing an active cable TV system.
   c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
   d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
   e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
   f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other "transmitter" can be applied to create a low frequency pressure waive (signal) without damaging or triggering the existing systems.
   g) All copper or steel waterlines and plastic or steel gas lines
6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
10. Contractor shall inform the District's Construction Managerno later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.10 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such

improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

H. ENVIRONMENTAL PROTECTION

1. No ground-disturbing activities shall be allowed outside of the project construction boundary. Construction fencing shall be placed at the boundary of the project site to clearly mark the limits of ground-disturbing activities.
2. All project-related traffic shall be restricted to designated access roads, routes, and construction areas within the project boundary. No vehicular or pedestrian traffic shall be allowed outside the designated project boundary.
3. To prevent sediment, hazardous materials, and other pollutants from washing or running off into the vernal swale and vernal pools outside of the project site, the contractor shall implement best management practices as identified in a Storm Water Pollution Prevention Plan (SWPPP).

1.11 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.12 TESTING

A. General: Refer to Section 01 45 00 – Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.

1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.13 ARCHEOLOGICAL AND CULTURAL RESOURCES

A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

A. GENERAL:

1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment.

3.04 TESTING AND OBSERVATION

A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.

B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.

3.05 SUBGRADE PREPARATION

A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.

3.06 FINAL SUBGRADE COMPACTION

A. Paved Areas: Upper 12" of all final subgrades supporting pavement sections and all other flatwork shall

be brought to specified moisture content and shall be uniformly compacted to not less than 90% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.

B. Other Fill and Backfill: Upper 12" of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.

C. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.07 FINISH GRADING

A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be "flat graded" to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be +-0.05'. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

3.15 SURPLUS MATERIAL

A. Excavated material not required for grading or backfill shall be removed from site at contractor's expense.

3.16 CLEANING

A. Refer to Section 01 74 00.

B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION

SECTION 32 12 00

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Asphalt paving mix designs.
2. Aggregate Base Course.
3. Seal Coat and Striping.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 310000, Earthwork.

1.03 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.

E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.

F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.

G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

A. Refer to General Conditions and Section 01 78 36.

1.06 REFERENCES AND STANDARDS

A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

F. CALTRANS Standard Specifications.

G. CAL-OSHA, Title 8, Section 1590 (e).

H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when

atmospheric temperature is below 40 degrees F.

2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.

B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

C. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

D. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

E. Any construction review of the Contractor's performance conducted by the owner’s representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

F. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

G. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

H. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

I. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.09 TESTING

A. General: Refer to Section 01 40 00 – Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sterilant: Soil sterilizer shall be Esplanade 200 SC or approved equal.

1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.

B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).

C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturer's.

D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.

E. Surface Course Aggregate: Mineral aggregates for Type "B" asphalt concrete, conforming to State Specifications 39-2.02, Type B, ½" maximum, medium grading. 3/8" maximum grading at Playcourt.

F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:

1. "Park-Top No. 302", Western Colloid Products.
2. "OverKote", Reed and Gram.
3. "Drivewalk", Conoco Oil.

G. Wood Headers and Stakes: Pressure treated.

H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.

1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.

I. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.

J. Crack Filler;

1. Cracks up to ½": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.
2. Cracks ¼" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
3. Cracks greater than 1": Hot Mix, Topeka.

K. Reclaimed Asphalt Paugment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% of the aggregate blend.

2.02 MIXES

A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.

B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.

C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.

D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.

E. Temperature of Warm Mix Asphalt: Mixing and placement; Per the approved manufactures heat range recommendations for mixing and placement.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.02 PREPARATION

A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area with a strong jet of water to remove all debris.

3.03 INSTALLATION

A. Asphalt Paving:

1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have

sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.

a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.

2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Surface Course:
   a. Comply with State Specifications, 39-6 except as modified below.
      1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.
      2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.
5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.
6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3” wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

B. Seal Coat:

1. Seal coat shall be applied no sooner than 30 days from time of asphalt placement, no exceptions.
2. Surface Preparation: surface and cracks shall be clean of all dirt, sand, oil or grease. All cracks shall be filled to a level condition after curing. Make multiple fill applications until a level condition is achieved. Failure to do so will be the reason for rejection. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt

concrete to full depth of damage and replace with compacted hot mix asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.

3. Seal Coat Seal Application: Thoroughly mix materials and apply in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
   a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
   b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

C. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer’s instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. Paints shall be delivered to the site in unopened containers.
   a. Paint shall not be diluted, or watered down.
   b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to PMS 293C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

D. Colors: As directed by Architect

3.04 DEFECTIVE ASPHALT;

Defective asphalt is as described below.

A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.

B. Asphalt not placed to the design grades.

C. Asphalt that ponds water.

D. Asphalt that was compacted below the minimum required temperature and is cracked.

E. Asphalt that fails to meet the minimum compaction requirements.

F. Asphalt that lacks the minimum thickness required per plan.

G. New asphalt contaminated by a petroleum product, or spilled paint.

H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,

I. Asphalt placed on pumping, unstable sub-grades.

3.05 CLEANING

A. Refer to Section 01 74 00.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

SECTION 32 16 00

SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. The Section describes the requirements for providing portland cement concrete paving, including, sidewalks and accessible routes of travel.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

2. Section 01 50 00, Construction Facilities and Temporary Controls.

3. Section 31 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

A. California Building Code, latest edition.

B. ACI Standards, ACI 301-20.

C. ASTM C94, Specification for Ready-Mixed Concrete.

D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

E. ASTM – American Society for Testing and Materials.

1.03 SUBMITTALS

A. Refer to Section 01 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

D. With concrete submittal, provide documented history of mix design performance.

1.04 QUALITY ASSURANCE

A. Use only new materials and products.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.06 WARRANTY

A. Refer to General Conditions and Section 01 78 36.

1.07 TESTING

A. General: Refer to Section 01 40 00 – Quality Requirements.

B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and

DSA.

1.08 ADEQUACY AND INSPECTION

A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.

B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.09 PROTECTION

A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.10 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: Portland cement, ASTM C150, Type II, per ACI 301-20.

B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.

C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 301-20.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.

E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Such admixture must receive prior approval and shall be included in original design mix.

F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.

G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface

coating, as approved by the Architect.

I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.

J. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3'-0" O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3" concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.

K. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; "Armor-Tile", "Access Tile Tactile Systems", or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35"). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).

L. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.

M. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.

N. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.

O. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed,non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

P. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.

Q. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.

R. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.

1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
4. Color: Custom color as selected by Architect.

S. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap,

or an approved equal.

T. Adhesive Anchoring (Epoxy): Simpson SetXP, or approved equal.

2.02 CONCRETE DESIGN AND CLASS

A. Class “B”: Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.

B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".

C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.

D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.03 MIXING OF CONCRETE

A. Conform to requirements of CBC, Chapter 19A.

B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-mixed Concrete.

1. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.

2. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.04 MATERIALS TESTING

A. Testing of concrete shall be performed per article 3.12 of this specification.

2.05 EQUIPMENT

A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.01 APPROVAL OF FORMS AND REINFORCEMENTS

A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.

B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.

C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.

D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.

1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.02 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.03 CLEANING

A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.

B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.04 FORMING

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Slope tie-wires downward to outside of wall.

G. Brace, anchor and support all cast-in items to prevent displacement or distortion.

H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

I. Concrete paving, Curbs, Curb and Gutters, Ramps:

1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20’ for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60’ on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
3. Isolation Joints: 3/8” felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
4. Exterior Concrete Paving: Install expansion joints at 20’ on center maximum, both directions, unless shown otherwise on plans.
5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.

a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.05 FORM COATING

A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

B. Before re-using form material, inspect, clean thoroughly and recoat.

C. Seal all cut edges.

3.06 INSTALLATION

A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.

B. Placing Tolerances:

1. Per ACI 301-20 Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.

C. Splices:

1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
   a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56” minimum for No. 6 bars. No. 4 bar shall have a minimum of 24” splice. 93 bar diameters for No. 7 bars and larger.
   b. All splices shall be staggered at 5 feet minimum.

3.07 INSPECTION

A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.

B. Slope of concrete forms and finish condition shall be checked with a two foot (2’) digital level.

3.08 PLACING OF CONCRETE

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the

concrete pour and finishing shall be replaced at no extra cost to the owner.

B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.

D. Remove form spreaders as placing of concrete progresses.

E. Place footings as monolithic and in one continuous pour.

F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.

H. Concrete Flatwork:

1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10’ for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.
2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.

I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.

J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing

temperatures.

K. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.09 CONCRETE FINISHES

A. Concrete Slab Finishing: Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:

1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
3. Under no circumstances can water be added to the top surface of freshly placed concrete.

B. Curb Finishing: Steel trowel.

C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼” radius x 1” deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.

1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.

D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

3.10 CURING

A. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.

1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.

B. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.

B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.

C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.

D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.

E. Defective concrete is:

1. Concrete that does not match the approved mix design for the given installation type.
2. Concrete not meeting specified 28-day strength.
3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
5. Concrete containing embedded wood or debris.
6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
7. Concrete not containing required embedded items.
8. Excessive Shrinkage, Traverse cracking, Crazing, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90

minutes from the time it was batched.

10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.

F. Patching: Install specified Patching Mortar per manufacturer's recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.

B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.

F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

B. Sequence and timing of form removal shall insure complete safety of concrete structure.

C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F

and above.

1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
2. Slab edge screeds or forms: 7 days.
3. Concrete columns and beam soffits: 28 days.

D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

A. Refer to Section 01 74 00.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION